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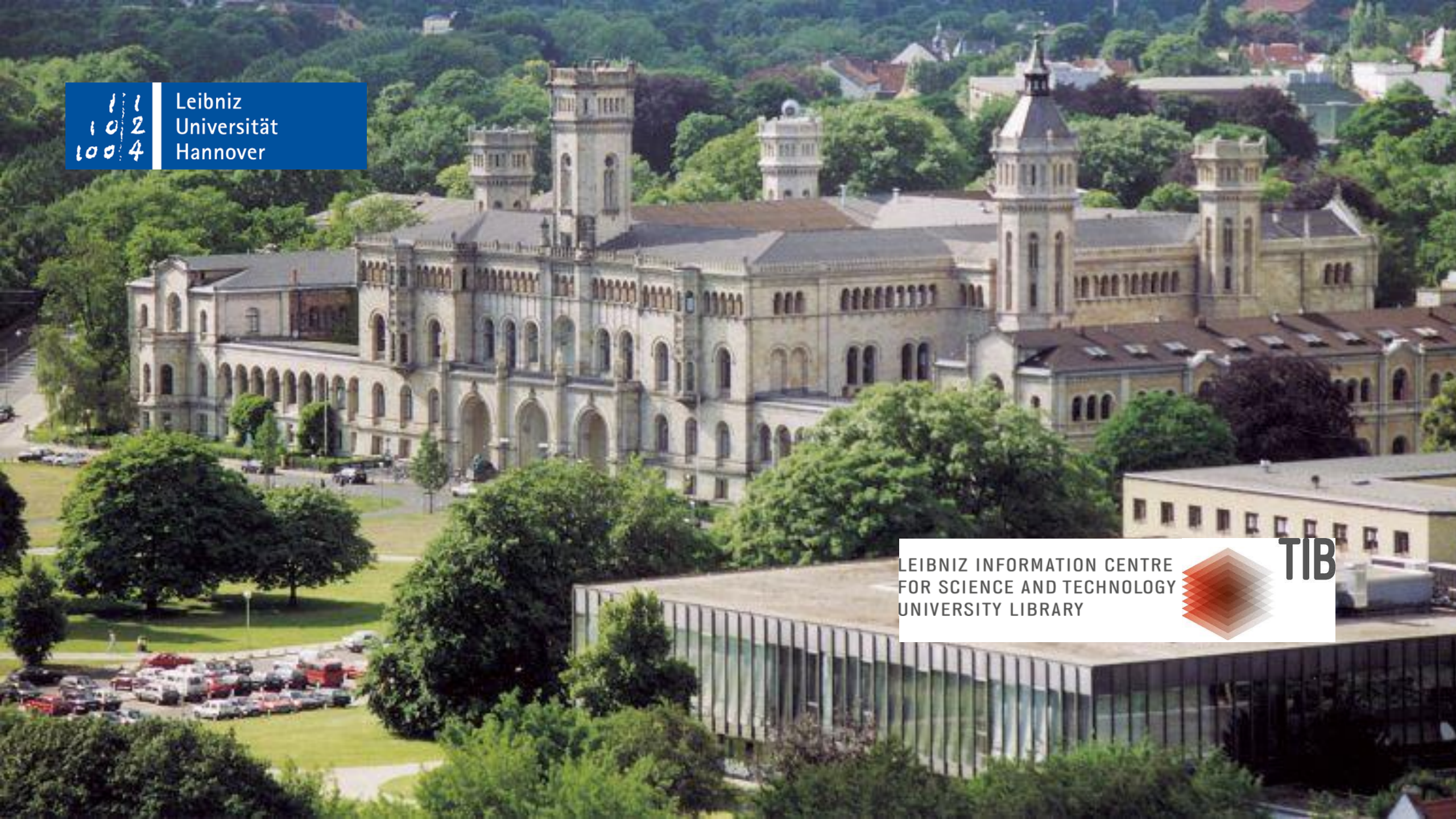
Prof. Dr. Sören Auer
Leibniz University of Hannover
TIB Technische Informationsbibliothek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Gottfried Wilhelm Leibniz
** 21. Juni/ 1. Juli 1646 in Leipzig*
† 14. November 1716 in Hannover

Leibniz Universität Hannover

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Namesake

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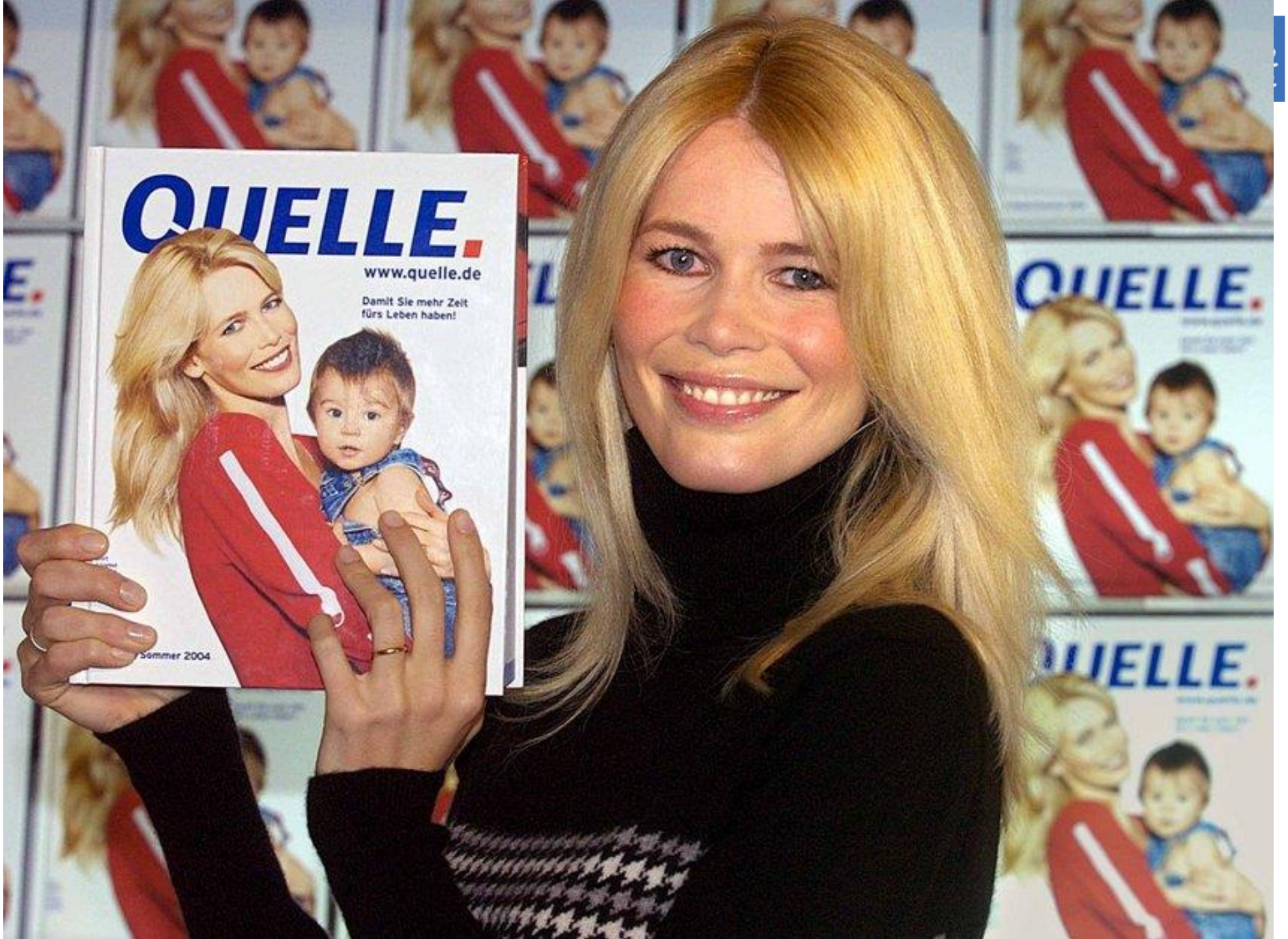
How did information flows change in the digital era?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Damit Sie mehr Zeit
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Sommer 2004

Computer

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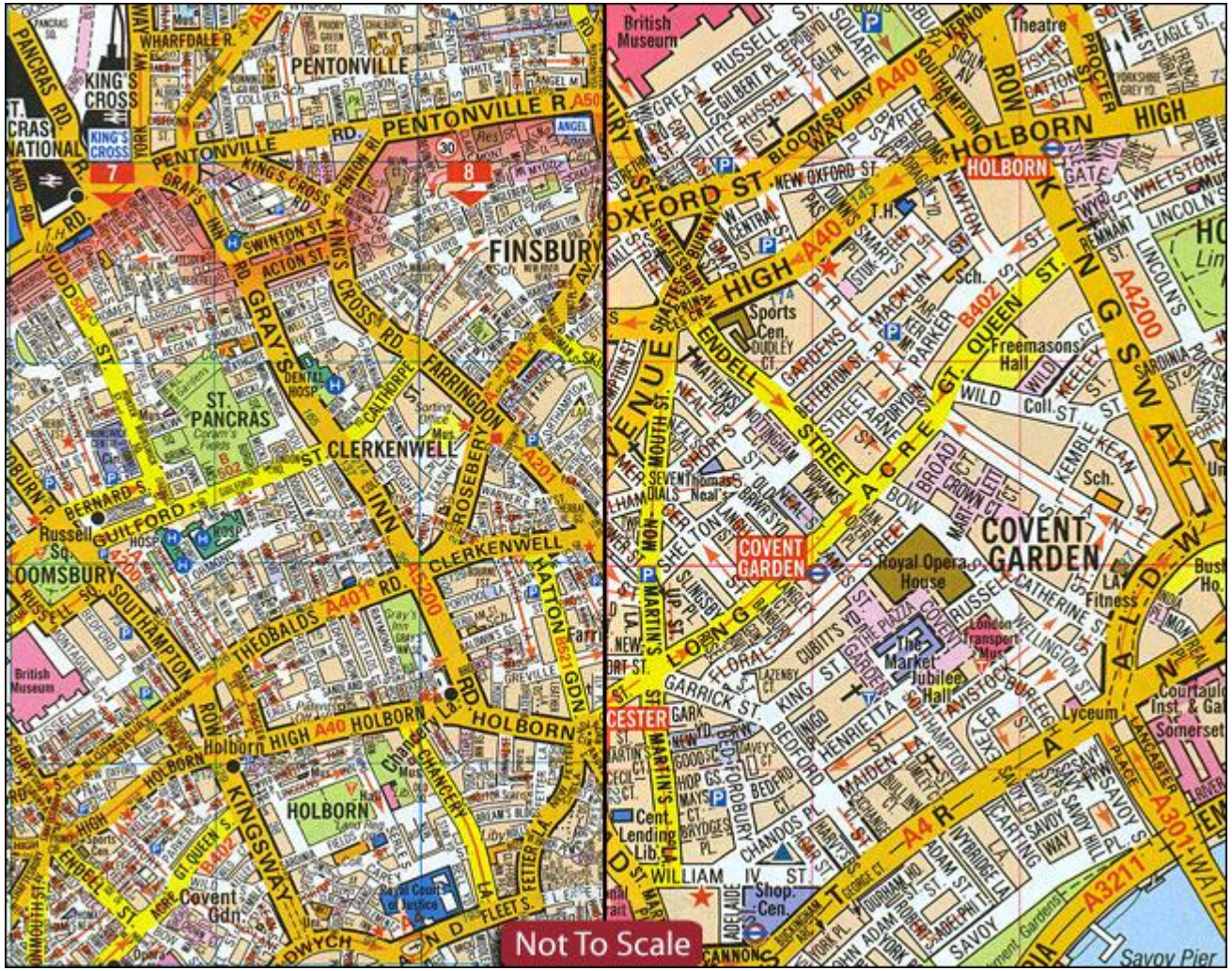
Road Maps



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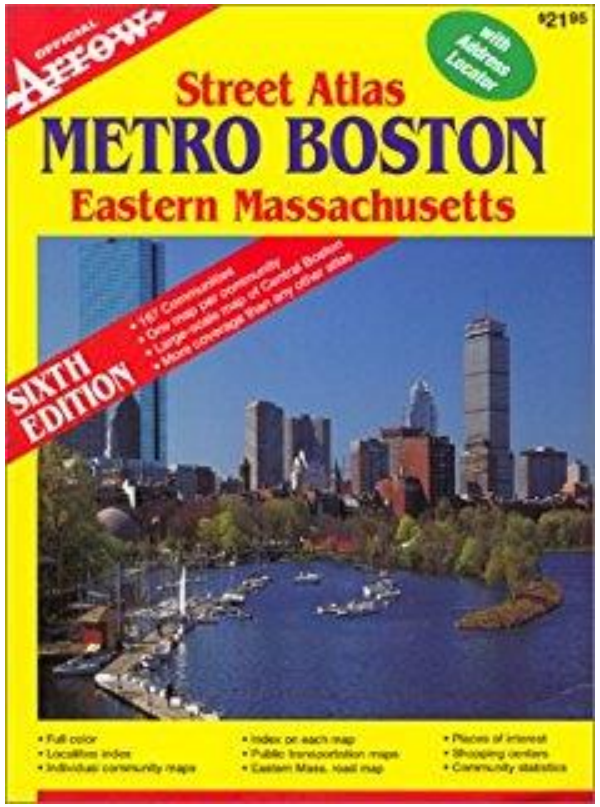
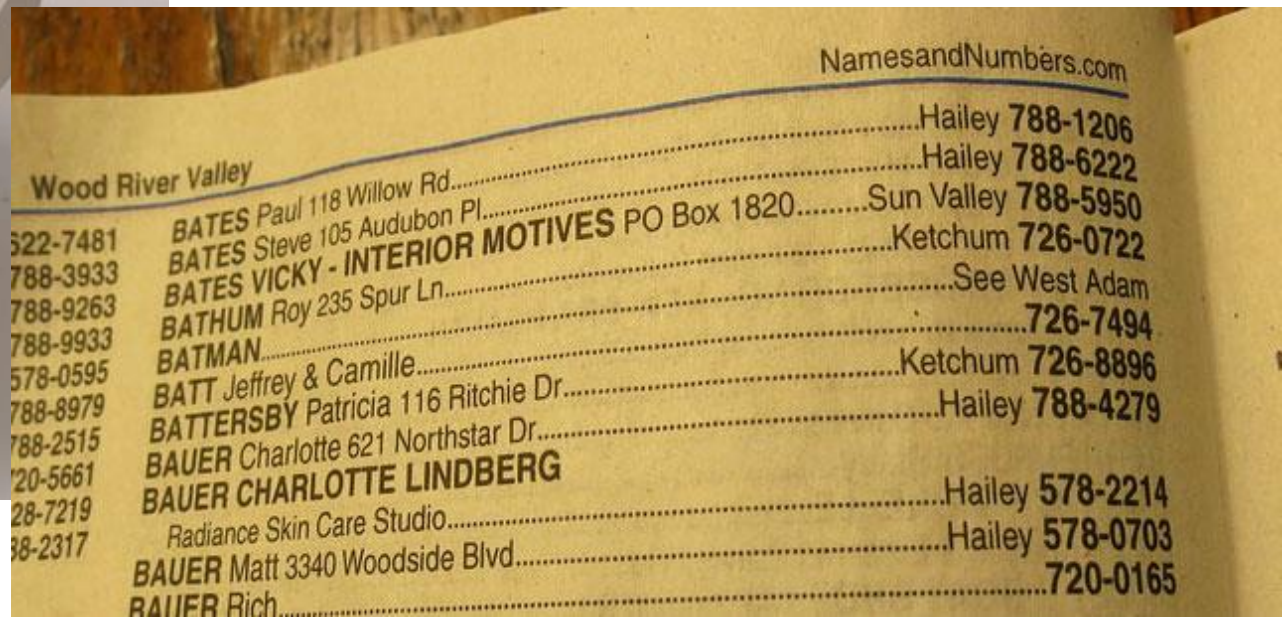


Source: https://images-na.ssl-images-amazon.com/images/I/5135QBYNWHL._SX348_BO1,204,203,200_.jpg

Phone Books



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Source: https://i0.wp.com/media.boingboing.net/wp-content/uploads/2017/06/Batman.jpg?w=640&ssl=1

How does it work today?

1-16 of over 300,000 results for "smartphone"

Sort by: Featured

Amazon Prime
- prime
- Free shipping for deliveries over EUR 29

For all customers with orders over €29 shipped by Amazon

Department
- Electronics & Photo
  - Mobile Phones & Smartphones
  - Mobile Phones & Communication
- Prime Video
  - Movies
  - TV shows
- See All 39 Departments

Avg. Customer Review
- & Up
- & Up
- & Up
- & Up

Brand
- Samsung
- Huawei
- LG Electronics
- Sony
- CUBOT
- HONOR
- HTC
- Apple
- Nokia
- Wiko
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Samsung Galaxy S9+ Smartphone (6,2 Zoll (15,7cm) 64GB interner Speicher, Dual SIM) ...

4.5 out of 5 stars 229

Samsung Galaxy Note 9

4.5 out of 5 stars 90

Samsung LED View Cover (EF-NG960) für das Galaxy S9, Violett

4.0 out of 5 stars 144

prime

Werbung

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4.0 out of 5 stars 46

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RUISEN-ONE-Twilight

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€79.99

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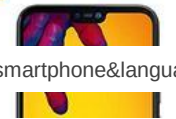
Best Seller



Huawei P20 lite Smartphone (14.83 cm (5.84 Inch), 64GB Internal Memory, 4GB RAM, 16 MP Plus 2

https://www.amazon.de/s?k=smartphone&language=en_GB&crid=1514IC1D4IVOJ&sprefix=smartphon%2Caps%2C153&ref=nb_sb_ss_i_1_9, 04.2019

Smartphones (4.691)*

Sortieren nach: Beliebteste zuerst

Ergebnisse in **Smartphones** werden angezeigt. Ergebnisse in allen Kategorien anzeigen.

Beliebteste Produkttypen

- LTE Smartphone — 3.625 Produkte
- Phablet — 2.023 Produkte
- Android Smartphone — 4.145 Produkte

Preis

- bis 95 € — 900
- 95 € bis 150 € — 1.185
- 150 € bis 200 € — 857
- 200 € bis 300 € — 840
- ab 300 € — 909

Serie

- Apple iPhone — 223
- Samsung Galaxy S — 216
- Samsung Galaxy A — 95
- Huawei P — 165
- Huawei Mate — 58

+ mehr

Samsung Galaxy S10
LTE Smartphone, 6,1 Zoll, Quad HD, 8 GB RAM, Android 9.0 Pie, 16 Megapixel, 3.400 mAh, Speic ...mehr
Note Ø 1,5 ★★★★½ 8
388 Angebote
664,99 – 1.341,40 €

Apple iPhone Xr
LTE Smartphone, 6,1 Zoll, HD, 3 GB RAM, iOS 12, 12 Megapixel, 2.942 mAh, Gewicht 194 g
Note Ø 1,6 ★★★★★ 111
923 Angebote
695,00 – 1.284,01 €

Huawei P30 Pro
LTE Smartphone, 6,47 Zoll, Full HD, Android 9.0 Pie, 40 Megapixel, 4.200 mAh, Speicher erwe ...mehr
Note Ø 1,5 ★★★★★ 2
196 Angebote
739,00 – 1.391,11 €

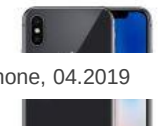
Xiaomi Mi 9
LTE Smartphone, 6,39 Zoll, Full HD, 6 GB RAM, Android 9.0 Pie, 48 Megapixel, 3.300 mAh, Gewicht 173 g
Note Ø 2,0 ★★★★½ 4
52 Angebote
445,00 – 580,00 €

Samsung Galaxy S10e
LTE Smartphone, 5,8 Zoll, Full HD, Android 9.0 Pie, 16 Megapixel, 3.100 mAh, Speicher erwe ...mehr
Note Ø 1,8 ★★★★½ 2
294 Angebote
549,49 – 857,79 €

Apple iPhone Xs
LTE Smartphone, 5,8 Zoll, Full HD, 4 GB RAM, iOS 12, 12 Megapixel, 2.658 mAh, Gewicht 177 g
Note Ø 1,6 ★★★★★ 235
482 Angebote
895,00 – 1.902,81 €

Huawei P20
LTE Smartphone, 5,8 Zoll, Full HD, 4 GB RAM, Android 9.0 Pie, 20 Megapixel, 3.400 mAh, Gewicht 165 g
Note Ø 1,8 ★★★★★ 222
194 Angebote
340,00 – 649,00 €

Samsung Galaxy S10 Plus
LTE Smartphone, 6,4 Zoll, Quad HD, Android 9.0 Pie, 16 Megapixel, 4.100 mAh, Speicher erweiterbar
Note Ø 1,6 ★★★★★ 3
247 Angebote
859,99 – 1.940,34 €



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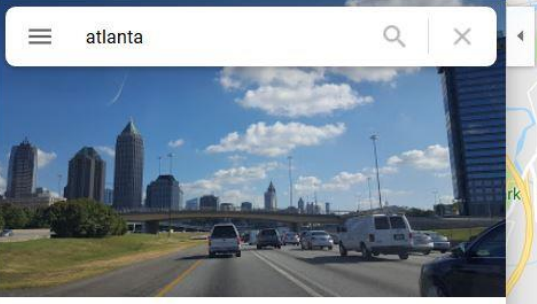
atlanta



Atlanta

Georgia

USA

Klar und vereinzelt Wolken · 17 °C
06:02

Routenplaner | Speichern | In der Nähe | An mein Smartphone senden | Teilen

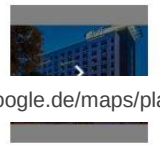
Fotos

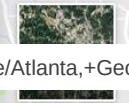
Kurzinfo

Atlanta ist die Hauptstadt des US-Bundesstaates Georgia. Die Stadt spielte sowohl während des Amerikanischen Bürgerkriegs als auch während der Bürgerrechtsbewegung in den 1960er-Jahren eine wichtige Rolle. Das Atlanta History Center erzählt von der Geschichte der Stadt, während die Martin Luther King Jr. National Historic Site dem Leben und Wirken des afroamerikanischen Bürgerrechtlers gewidmet ist. Im Centennial Olympic Park, der für die Olympischen Spiele 1996 in Downtown gebaut wurde, befindet sich das eindrucksvolle Georgia Aquarium.

Hotels

Info zur Preisangabe





https://www.google.de/maps/place/Atlanta,+Georgia,+USA/@33.756009,-84.4151149,13.5z/data=!4m5!3m4!1s0x88f5045d6993098d:0x66fede2f990b630b!8m2!3d33.7489954!4d-84.3879824, 04.2019

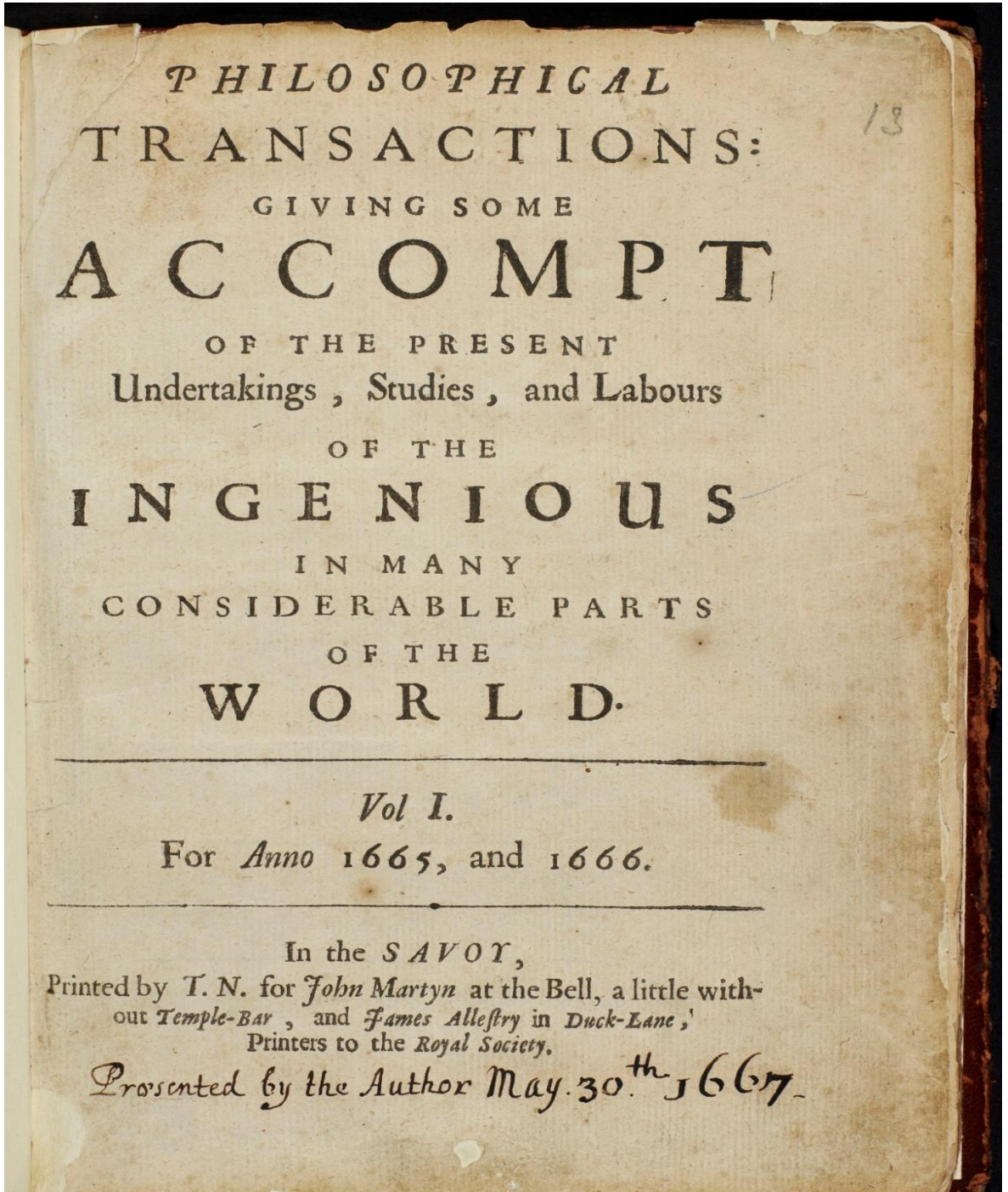
The World of Publishing & Communication has profundely changed

- **New means adapted to the new posibilities** were developed, e.g. „zooming“, dynamics
- **Business models** changed completely
- More focus on data, interlinking of **data / services and search** in the data
- Integration, **crowdsourcing** play an important role

What about Scholarly Communication?

Scientific publishing in the 17th century

One of the earliest research journals:
Philosophical Transactions of the Royal Society


PHILOSOPHICAL
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Printers to the Royal Society.
Prosented by the Author May. 30th 1667.

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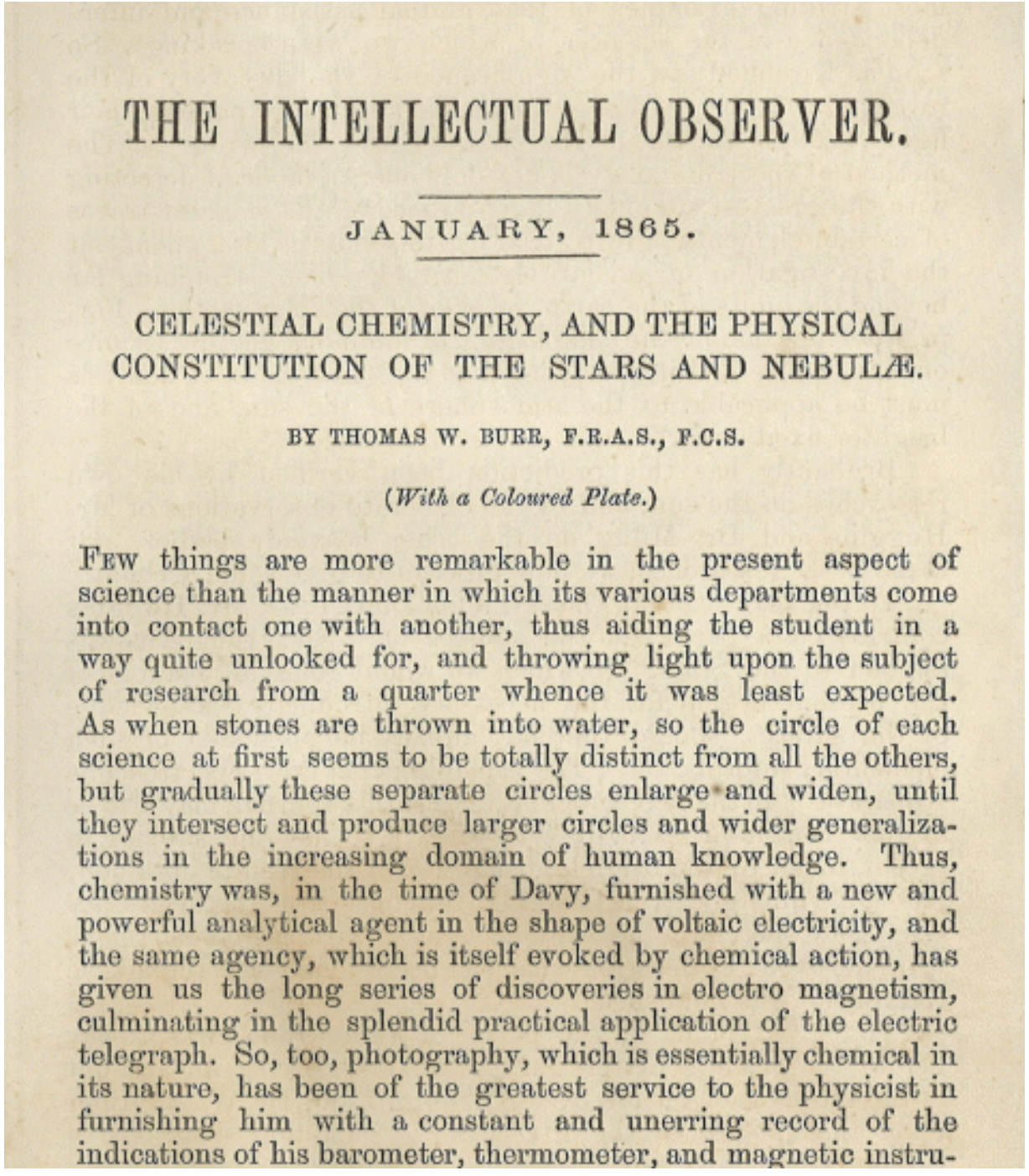
Scholarly communication in 1865



THE INTELLECTUAL OBSERVER.

JANUARY, 1865.

CELESTIAL CHEMISTRY, AND THE PHYSICAL CONSTITUTION OF THE STARS AND NEBULÆ.

BY THOMAS W. BURR, F.R.A.S., F.C.S.

(*With a Coloured Plate.*)

FEW things are more remarkable in the present aspect of science than the manner in which its various departments come into contact one with another, thus aiding the student in a way quite unlooked for, and throwing light upon the subject of research from a quarter whence it was least expected. As when stones are thrown into water, so the circle of each science at first seems to be totally distinct from all the others, but gradually these separate circles enlarge and widen, until they intersect and produce larger circles and wider generalizations in the increasing domain of human knowledge. Thus, chemistry was, in the time of Davy, furnished with a new and powerful analytical agent in the shape of voltaic electricity, and the same agency, which is itself evoked by chemical action, has given us the long series of discoveries in electro magnetism, culminating in the splendid practical application of the electric telegraph. So, too, photography, which is essentially chemical in its nature, has been of the greatest service to the physicist in furnishing him with a constant and unerring record of the indications of his barometer, thermometer, and magnetic instru-

Source: http://www.stsci.edu/~volk/old_spectroscopy_paper1.gif

Publishing in 1970s

A Relational Model of Data for Large Shared Data Banks

E. F. CODD
IBM Research Laboratory, San Jose, California

Future users of large data banks must be protected from having to know how the data is organized in the machine (the internal representation). A prompting service which supplies such information is not a satisfactory solution. Activities of users at terminals and most application programs should remain unaffected when the internal representation of data is changed and even when some aspects of the external representation are changed. Changes in data representation will often be needed as a result of changes in query, update, and report traffic and natural growth in the types of stored information.

Existing noninferential, formatted data systems provide users with tree-structured files or slightly more general network models of the data. In Section 1, inadequacies of these models are discussed. A model based on *n*-ary relations, a normal form for data base relations, and the concept of a universal data sublanguage are introduced. In Section 2, certain operations on relations (other than logical inference) are discussed and applied to the problems of redundancy and consistency in the user's model.

KEY WORDS AND PHRASES: data bank, data base, data structure, data organization, hierarchies of data, networks of data, relations, derivability, redundancy, consistency, composition, join, retrieval language, predicate calculus, security, data integrity
CR CATEGORIES: 3.70, 3.73, 3.75, 4.20, 4.22, 4.29

The relational view (or model) of data described in Section 1 appears to be superior in several respects to the graph or network model [3, 4] presently in vogue for noninferential systems. It provides a means of describing data with its natural structure only—that is, without superimposing any additional structure for machine representation purposes. Accordingly, it provides a basis for a high level data language which will yield maximal independence between programs on the one hand and machine representation and organization of data on the other.

A further advantage of the relational view is that it forms a sound basis for treating derivability, redundancy, and consistency of relations—these are discussed in Section 2. The network model, on the other hand, has spawned a number of confusions, not the least of which is mistaking the derivation of connections for the derivation of relations (see remarks in Section 2 on the "connection trap").

Finally, the relational view permits a clearer evaluation of the scope and logical limitations of present formatted data systems, and also the relative merits (from a logical standpoint) of competing representations of data within a single system. Examples of this clearer perspective are cited in various parts of this paper. Implementations of systems to support the relational model are not discussed.

1.2. Data Dependencies in Present Systems

The provision of data description tables in recently developed information systems represents a major advance toward the goal of data independence [5, 6, 7]. Such tables facilitate changing certain characteristics of the data representation stored in a data bank. However, the variety of data representation characteristics which can be changed *without logically impairing some application programs* is still quite limited. Further, the model of data with which users interact is still cluttered with representational prop-

Source: https://www.seas.upenn.edu/~zives/03f/cis550/codd.pdf

Scientific publishing today

WE HAVE

open access | ORCID | arXiv.org

BUT

- Mainly based on PDF
- Is only partially machine-readable
- Does not preserve structure
- Does not allow embedding of semantics
- Does not facilitate interactivity / dynamicity / repurposing
- …

AGDISTIS - Graph-Based Disambiguation of Named Entities using Linked Data

Ricardo Usbeck[1,2], Axel-Cyrille Ngonga Ngomo[1], Michael Röder[1,2], Daniel Gerber[1], Sandro Athaide Coelho[3], Sören Auer[4], and Andreas Both[2]

[1] University of Leipzig, Germany , [2] R&D, Unister GmbH, Germany, [3] Federal University of Juiz de Fora, Brazil, [4] University of Bonn & Fraunhofer IAIS, Germany
email: {usbeck|ngonga}@informatik.uni-leipzig.de

Abstract. Over the last decades, several billion Web pages have been made available on the Web. The ongoing transition from the current Web of unstructured data to the Web of Data yet requires scalable and accurate approaches for the extraction of structured data in RDF (Resource Description Framework) from these websites. One of the key steps towards extracting RDF from text is the disambiguation of named entities. While several approaches aim to tackle this problem, they still achieve poor accuracy. We address this drawback by presenting AGDISTIS, a novel knowledge-base-agnostic approach for named entity disambiguation. Our approach combines the Hypertext-Induced Topic Search (HITS) algorithm with label expansion strategies and string similarity measures. Based on this combination, AGDISTIS can efficiently detect the correct URIs for a given set of named entities within an input text. We evaluate our approach on eight different datasets against state-of-the-art named entity disambiguation frameworks. Our results indicate that we outperform the state-of-the-art approach by up to 29% F-measure.

1 Introduction

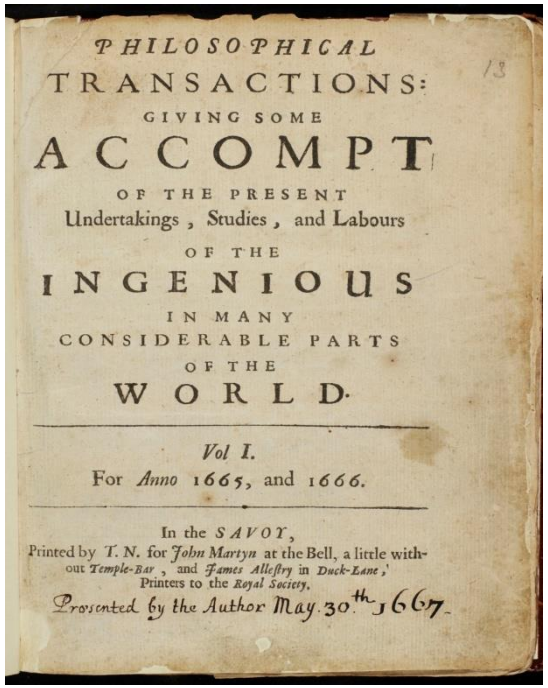
The vision behind the Web of Data is to provide a new machine-readable layer to the Web where the content of Web pages is annotated with structured data (e.g., RDFa [1]). However, the Web in its current form is made up of at least 15 billion Web pages.[1] Most of these websites are unstructured in nature. Realizing the vision of a usable and up-to-date Web of Data thus requires scalable and accurate natural-language-processing approaches that allow extracting RDF from such unstructured data. Three tasks play a central role when extracting RDF from unstructured data: named entity recognition (NER), named entity disambiguation (NED), also known as entity linking [16], and relation extraction (RE). For the first sentence of Example 1, an accurate named entity recognition approach would return the strings `Barack Obama` and `Washington, D.C.`. A high-quality DBpedia-based named entity disambiguation (NED) approach would use these already recognized named entities and map the strings

[1] Data gathered from `http://www.worldwidewebsize.com/` on January 4th, 2014.

Source: https://www.researchgate.net/publication/264412537_AGDISTIS_-_Graph-Based_Disambiguation_of_Named_Entities_using_Linked_Data

Scholarly Communication has not changed (much)

17th century



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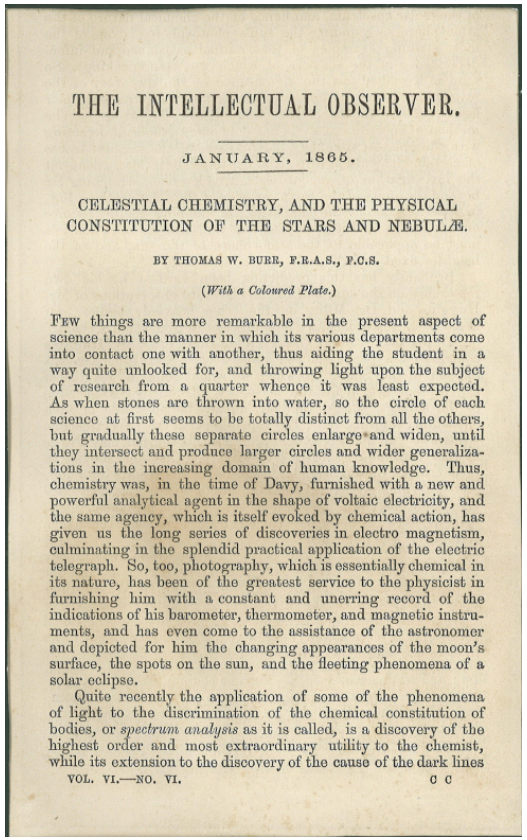
19th century



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Quite recently the application of some of the phenomena of light to the discrimination of the chemical constitution of bodies, or *spectrum analysis* as it is called, is a discovery of the highest order and most extraordinary utility to the chemist, while its extension to the discovery of the cause of the dark lines

20th century

A Relational Model of Data for Large Shared Data Banks

E. F. Codd
IBM Research Laboratory, San Jose, California

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CR CATEGORIES: 3.70, 3.73, 3.75, 4.20, 4.22, 4.29

1. Relational Model and Normal Form

1.1. Introduction

This paper is concerned with the application of elementary relation theory to systems which provide shared access to large banks of formatted data. Except for a paper by Childs [1], the principal application of relations to data

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1.2. Data Dependencies in Present Systems

The provision of data description tables in recently developed information systems represents a major advance toward the goal of data independence [5, 6, 7]. Such tables facilitate changing certain characteristics of the data representation stored in a data bank. However, the variety of data representation characteristics which can be changed *without logically impairing some application programs* is still quite limited. Further, the model of data with which users interact is still cluttered with representational properties, particularly in regard to the representation of collections of data (as opposed to individual items). Three of the principal kinds of data dependencies which still need to be removed are: ordering dependence, indexing dependence, and access path dependence. In some systems these dependencies are not clearly separable from one another.

1.2.1. *Ordering Dependence.* Elements of data in a data bank may be stored in a variety of ways, some involving no concern for ordering, some permitting each element to participate in one ordering only, others permitting each

21th century

AGDISTIS - Graph-Based Disambiguation of Named Entities using Linked Data

Ricardo Usbeck[1,2], Axel-Cyrille Ngonga Ngomo[1], Michael Röder[1,2], Daniel Gerber[1], Sandro Athaide Coelho[3], Sören Auer[4], and Andreas Both[2]

[1] University of Leipzig, Germany , [2] R & D, Unister GmbH, Germany, [3] Federal University of Juiz de Fora, Brazil, [4] University of Bonn & Fraunhofer IAIS, Germany
email: {usbeck|ngonga}@informatik.uni-leipzig.de

Abstract. Over the last decades, several billion Web pages have been made available on the Web. The ongoing transition from the current Web of unstructured data to the Web of Data yet requires scalable and accurate approaches for the extraction of structured data in RDF (Resource Description Framework) from these websites. One of the key steps towards extracting RDF from text is the disambiguation of named entities. While several approaches aim to tackle this problem, they still achieve poor accuracy. We address this drawback by presenting AGDISTIS, a novel knowledge-base-agnostic approach for named entity disambiguation. Our approach combines the Hypertext-Induced Topic Search (HITS) algorithm with label expansion strategies and string similarity measures. Based on this combination, AGDISTIS can efficiently detect the correct URIs for a given set of named entities within an input text. We evaluate our approach on eight different datasets against state-of-the-art named entity disambiguation frameworks. Our results indicate that we outperform the state-of-the-art approach by up to 29% F-measure.

1 Introduction

The vision behind the Web of Data is to provide a new machine-readable layer to the Web where the content of Web pages is annotated with structured data (e.g., RDFa [1]). However, the Web in its current form is made up of at least 15 billion Web pages.[1] Most of these websites are unstructured in nature. Realizing the vision of a usable and up-to-date Web of Data thus requires scalable and accurate natural-language-processing approaches that allow extracting RDF from such unstructured data. Three tasks play a central role when extracting RDF from unstructured data: named entity recognition (NER), named entity disambiguation (NED), also known as entity linking [16], and relation extraction (RE). For the first sentence of Example 1, an accurate named entity recognition approach would return the strings `Barack Obama` and `Washington, D.C.`. A high-quality DBpedia-based named entity disambiguation (NED) approach would use these already recognized named entities and map the strings

[1] Data gathered from `http://www.worldwidewebsize.com/` on January 4th, 2014.

Meanwhile other information intense domains were completely disrupted:
mail order catalogs, street maps, phone books, …

We need to rethink the way how research is represented and communicated

Challenges we are facing:

Digitalisation of Science	Monopolisation by commercial actors	Reproducibility Crisis	Proliferation of publications	Deficiency of Peer Review
▪ Data integration and analysis ▪ Digital collaboration	▪ Publisher look-in effects ▪ Maximization of profits [1]	▪ Majority of experiments are hard or not reproducible [2]	▪ Publication output doubled within a decade ▪ continues to rise [3]	▪ Deteriorating quality [4] ▪ Predatory publishing

[1] http://thecostofknowledge.com, https://www.projekt-deal.de
[2] M. Baker: *1,500 scientists lift the lid on reproducibility*, *Nature,* 2016.
[3] *Science and Engineering Publication Output Trends*, National Science Foundation, 2018.
[4] J. Couzin-Frankel: *Secretive and Subjective, Peer Review Proves Resistant to Study.* Science, 2013.

Proliferation of scientific literature

Science and engineering articles by region, country: 2004 and 2014

Rank	Region, country, or economy	2004	2014	Average annual growth rate (%)	2014 world total (%)	2014 cumulative world total (%)
na	World	1,272,362	2,290,294	6.1	100.0	na
1	United States	336,194	431,623	2.5	18.8	18.8
2	China	110,388	395,588	13.6	17.3	36.1
3	Germany	72,177	107,747	4.1	4.7	40.8
4	India	28,752	106,574	14.0	4.7	45.5
5	Japan	95,999	103,793	0.8	4.5	50.0
6	United Kingdom	75,119	101,536	3.1	4.4	54.4
7	France	53,375	74,269	3.4	3.2	57.7
8	Italy	42,647	70,453	5.1	3.1	60.8
9	South Korea	27,029	63,748	9.0	2.8	63.5
10	Canada	40,624	60,916	4.1	2.7	66.2
11	Spain	30,977	56,604	6.2	2.5	68.7
12	Brazil	18,814	53,152	10.9	2.3	71.0
13	Australia	26,277	52,269	7.1	2.3	73.3
14	Russia	26,869	43,487	4.9	1.9	75.2
15	Iran	4,952	36,539	22.1	1.6	76.8

Source: National Science Foundation: Science and Engineering Publication Output Trends: https://www.nsf.gov/statistics/2018/nsf18300/nsf18300.pdf

Reproducibility Crisis

1,500 scientists lift the lid on reproducibility

Monya Baker in *Nature,* 2016. **533** (7604): 452–454. doi:10.1038/533452a:

- 70% failed to reproduce at least one other scientist's experiment
- 50% failed to reproduce one of their own experiments

Failure to reproduce results among disciplines

(in brackets own results)

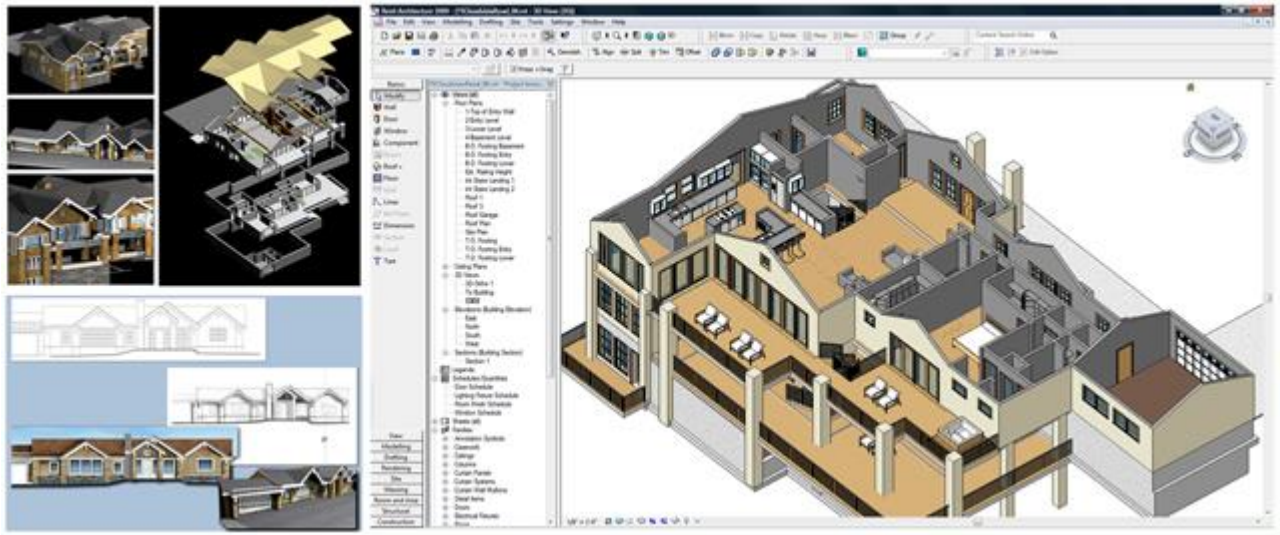
chemistry	87%	(64%)
biology	77%	(60%)
physics and engineering	69%	(51%)
Earth sciences	64%	(41%)

Source: © Stanford Medicine - Stanford University

Duplication and Inefficiency

How can we avoid duplication if the terminology, research problems, approaches, methods, characteristics, evaluations, … are not properly defined and identified?

How would you build an engine / building without properly defining their parts, relationships, materials, characteristics …?



Source: https://thumbs.worthpoint.com/zoom/images2/1/0316/22/revell-4-visible-8-engine-plastic_1_d2162f52c3fa3a6f72d2722f6c50b7b2.jpg

Source: http://xnewlook.com/cad-and-revit-3d-design.html/bill-ferguson-portfolio-computer-graphics-games-cad-related-3d-models-cad-and-revit-design

Root Cause –
Deficiency of Scholarly Communication?

Lack of…

Transparency	Integratability	Machine assistance
information is hidden in text	fitting different research results together	unstructured content is hard to process

Identifyability	Collaboration	Overview
of concepts beyond metadata	one brain barrier	Schientists look for the needle in the haystack

AUSLEIHEN & BESTELLEN | RECHERCHIEREN & ENTDECKEN | LERNEN & ARBEITEN | PUBLIZIEREN & ARCHIVIEREN | FORSCHUNG & ENTWICKLUNG | DIE TIB

CRISPR

Nur im Bibliothekskatalog der TIB suchen

Hier geht es zum klassischen Katalog

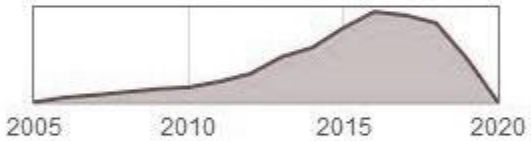
Search for CRISPR:
> 9.000 Results

Seite 1 von 9.881 Ergebnissen

Sortieren nach: Relevanz | Aktualität | Titel

Treffer filtern

Erscheinungsjahr



Ok

Medientyp

- Aufsatz (Zeitschrift) (6.870)
- Patent (2.619)
- Hochschulschrift (127)
- Sonstige (82)
- Aufsatz (Konferenz) (58)

+ Mehr anzeigen

Für folgende Begriffe wurden Synonyme verwendet: CRISPR

Suche ohne Synonyme: CRISPR

« ‹ 1 2 3 4 5 6 7 ›

CRISPR human trial.(clustered regularly interspaced short palindromic repeats)

Online Contents | 2016

cited: 0 | score: 310.36673

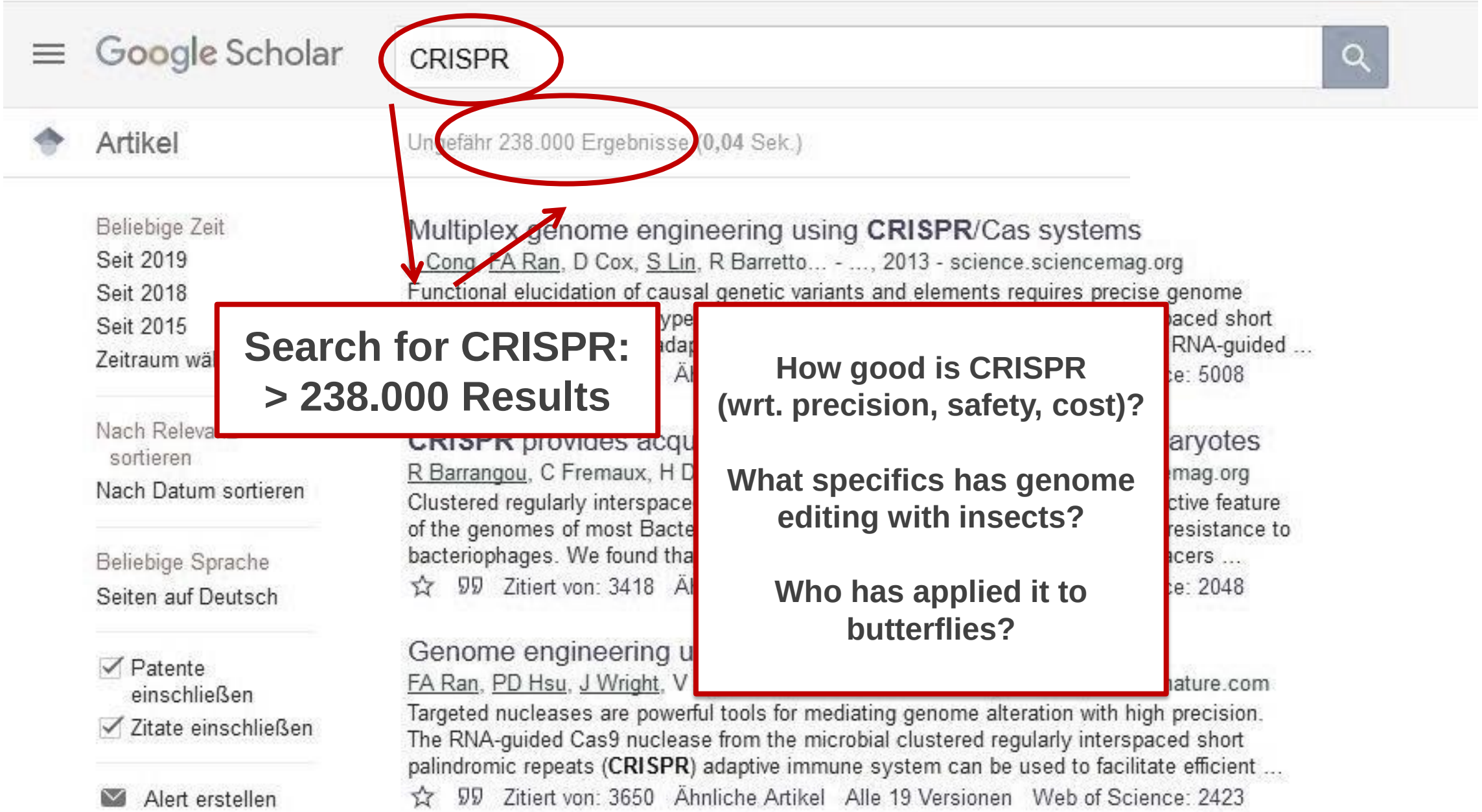
Advances in clustered regularly interspaced short palindromic repeats - A review

Wang, L. / He, J. / Wang, J. | British Library Online Contents | 2011

cited: 0 | score: 297.1446

l regularly interspaced

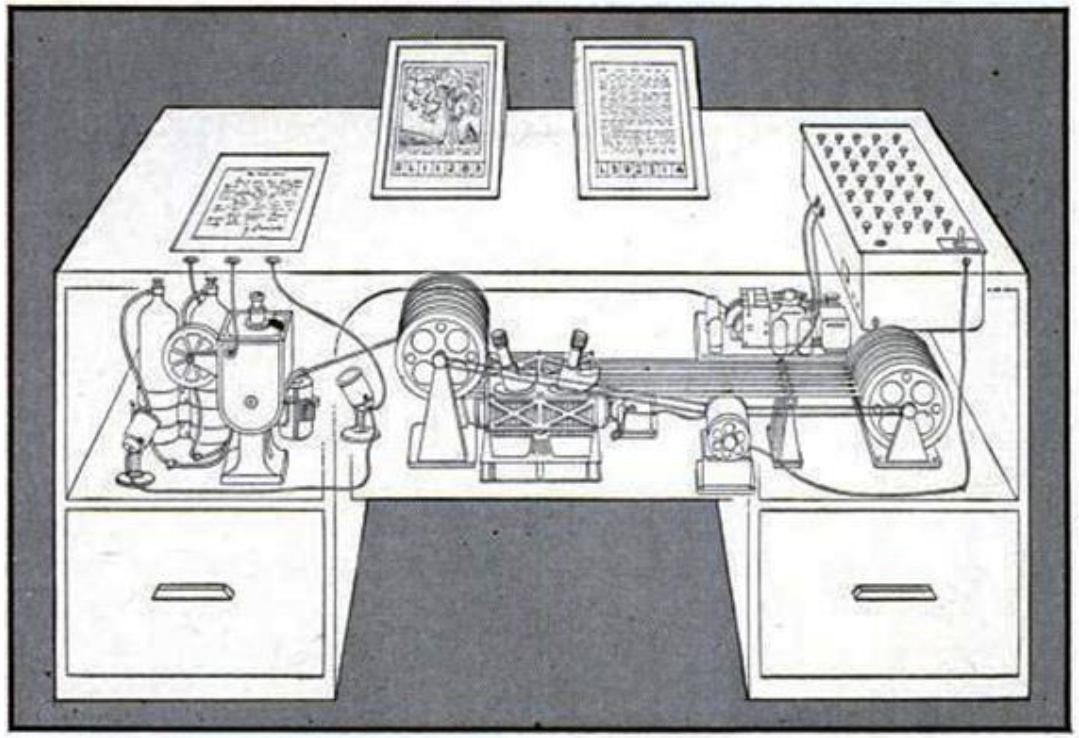
Source: https://www.tib.eu/de/suchen/?id=198&tx_tibsearch_search%5Bquery%5D=CRISPR&tx_tibsearch_search%5Bsrt%5D=rk&tx_tibsearch_search%5Bcnt%5D=20, 04.2019



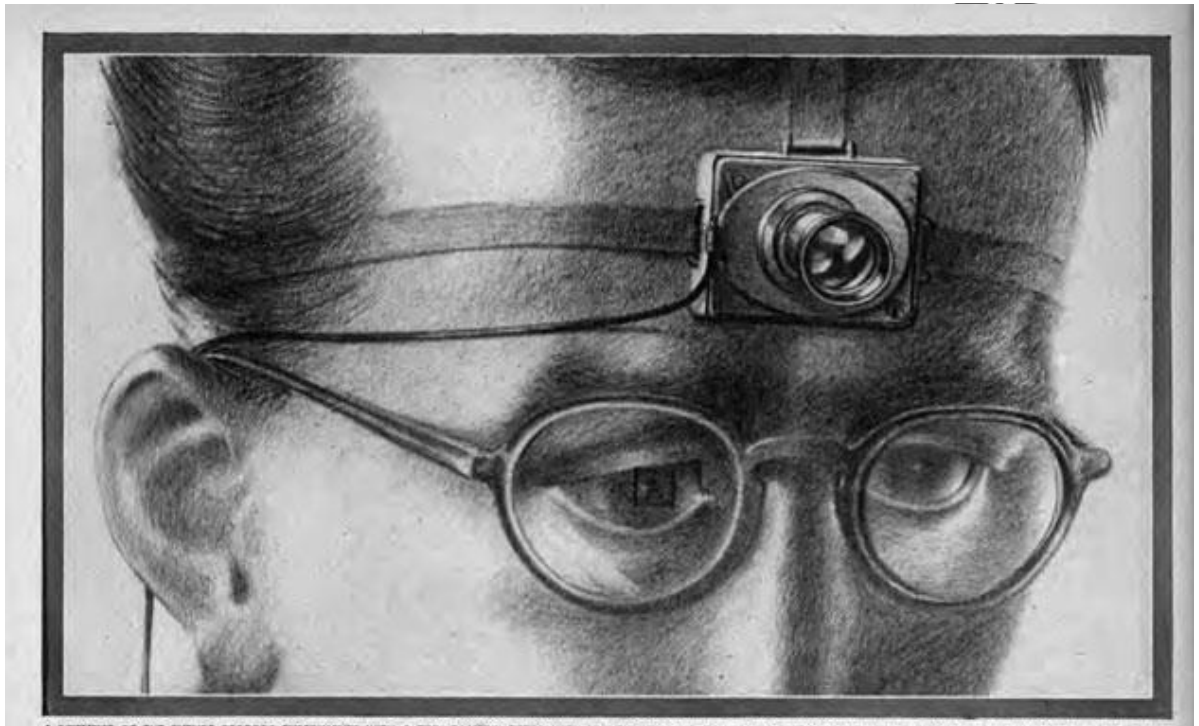
Source: https://scholar.google.de/scholar?hl=de&as_sdt=0%2C5&q=CRISPR&btnG=, 04.2019

How can we fix it?

Realizing Vannevar Bush‘s vision of Memex



Source: http://photos1.blogger.com/blogger/5874/1071/1600/Memex.jpg



A SCIENTIST OF THE FUTURE RECORDS EXPERIMENTS WITH A TINY CAMERA FITTED WITH UNIVERSAL-FOCUS LENS. THE SMALL SQUARE IN THE EYEGLASS AT THE LEFT SIGHTS THE OBJECT

AS WE MAY THINK

A TOP U. S. SCIENTIST FORESEES A POSSIBLE FUTURE WORLD IN WHICH MAN-MADE MACHINES WILL START TO THINK

by VANNEVAR BUSH

DIRECTOR OF THE OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

Condensed from the *Atlantic Monthly*, July 1945

This has not been a scientists' war; it has been a war in which all have had a part. The scientists, burying their old professional competition in the demand of a common cause, have shared greatly and learned much. It has been exhilarating to work in effective partnership. What are the scientists to do next?

For the biologists, and particularly for the medical scientists, there can be little indecision, for their war work has hardly required them to leave the old paths. Many indeed have been able to carry on their war research in their familiar peacetime laboratories. Their objectives remain much the same.

It is the physicists who have been thrown most violently off stride, who have left academic pursuits for the making of strange destructive gadgets, who have had to devise new methods for their unanticipated assignments.

ress, and the effort to bridge between disciplines is correspondingly superficial.

Professionally our methods of transmitting and reviewing the results of research are generations old and by now are totally inadequate for their purpose. If the aggregate time spent in writing scholarly works and in reading them could be evaluated, the ratio between these amounts of time might well be startling. Those who conscientiously attempt to keep abreast of current thought, even in restricted fields, by close and continuous reading might well shy away from an examination calculated to show how much of the previous month's efforts could be produced on call.

Mendel's concept of the laws of genetics was lost to the world for a generation because his publication did not reach the few who were capable

been part of a great team. Now one asks where they will find objectives

Publication has been extended far beyond our present ability to make real

Source: http://tntindex.blogspot.com/2014/10/tabletalk-vannevar-bushs-memex.html

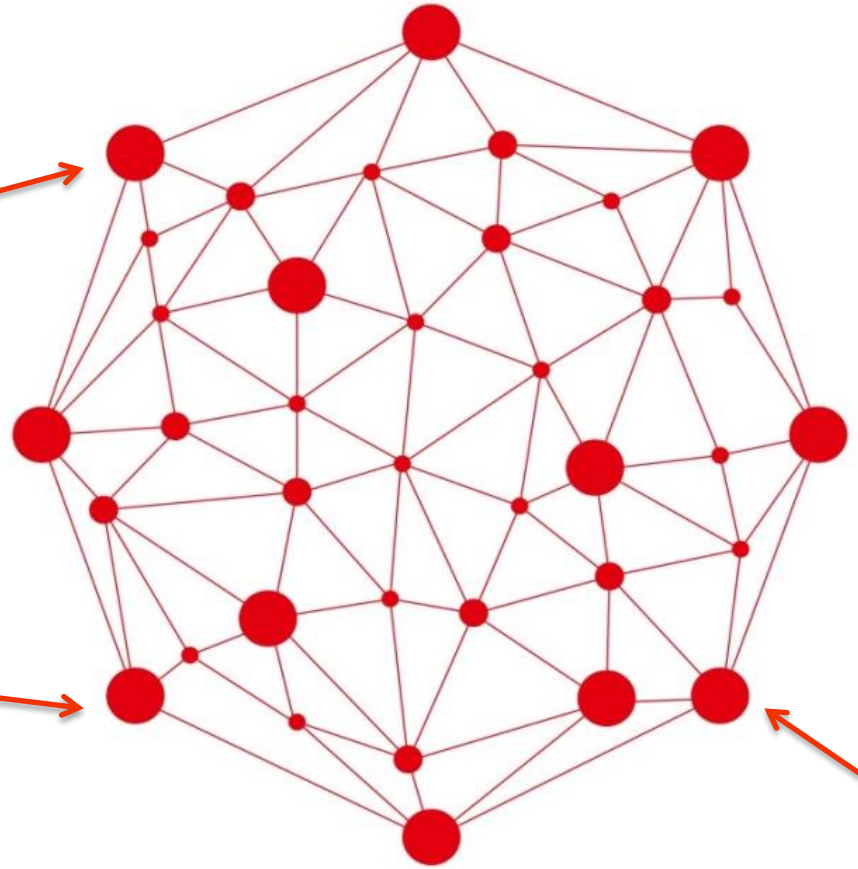
Concepts

Overarching Concepts

- Research problems
- Definitions
- Research approaches
- Methods

Artefacts

- Publications
- Data
- Software
- Image/Audio/Video
- Knowledge Graphs / Ontologies



Domain specific Concepts

Mathematics	Physics	Chemistry	Computer Science	Technology	Architecture
• Definitions • Theorems • Proofs • Methods • …	• Experiments • Data • Models • …	• Substances • Structures • Reactions • …	• Concepts • Implemen-tations • Evaluations • …	• Standards • Processes • Elements • Units, Sensor data	• Regulations • Elements • Models • …

Linked Data Principles

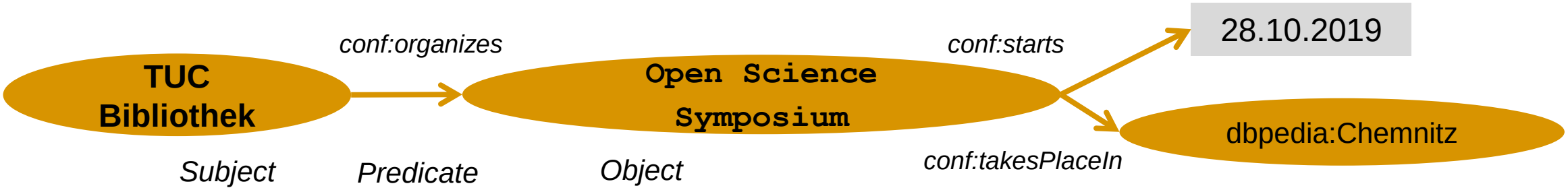
Addressing the neglected third V (Variety)

1. Use **URIs** to **identify** the “things” in your data
2. Use **http:// URIs** so people (and machines) can **look** them **up** on the web
3. When a URI is looked up, **return** a **description** of the thing **in** the W3C **Resource Description Format (RDF)**
4. Include **links to related things**

http://www.w3.org/DesignIssues/LinkedData.html

RDF & Linked Data in a Nutshell

1. Graph based RDF data model consisting of S-P-O statements (facts)



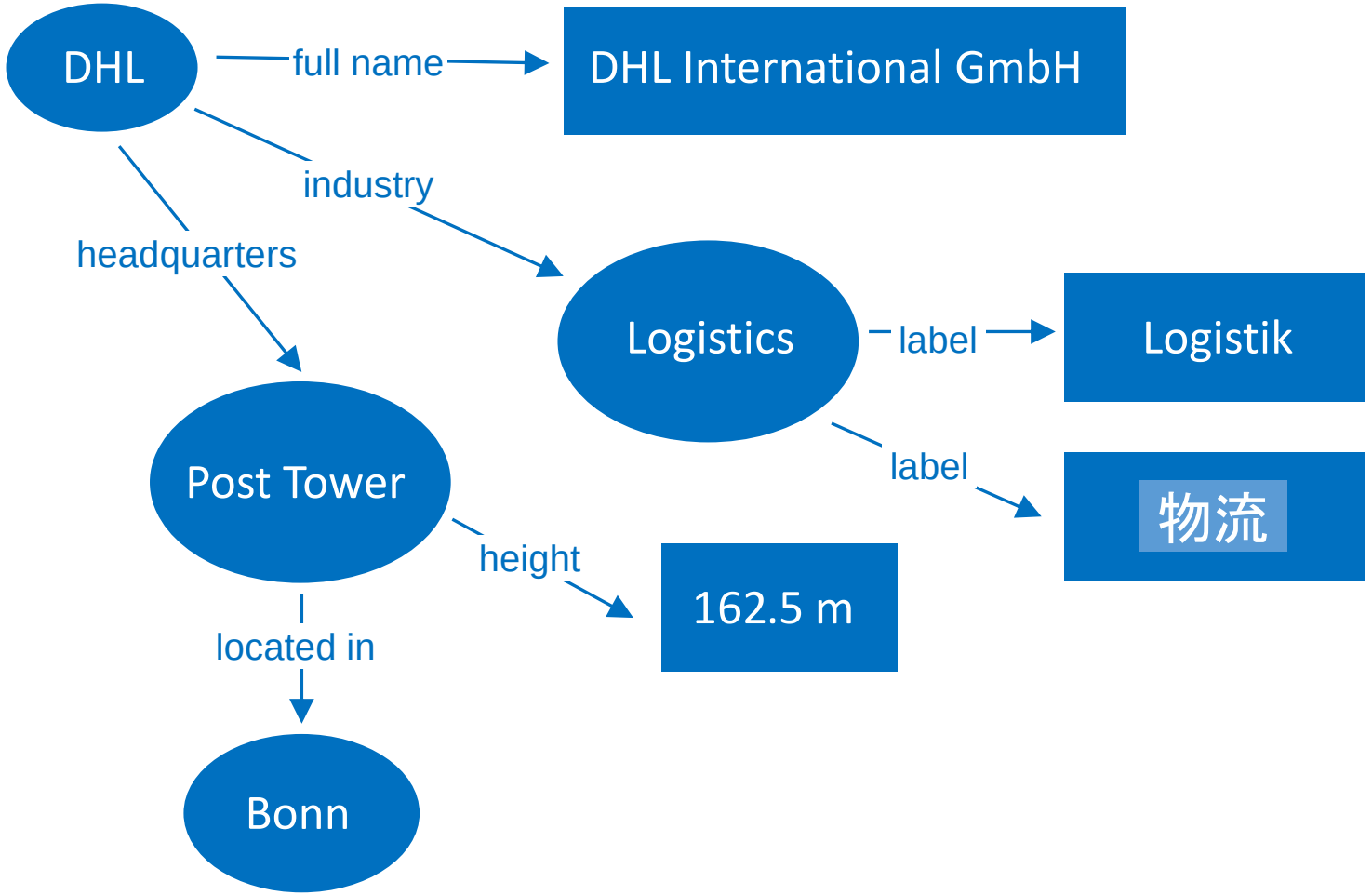
2. Serialised as RDF Triples:

```
TUC_Bibliothek          conf:organizes       OpenScienceSymposium .
OpenScienceSymposium    conf:starts          "2019-10-28"^^xsd:date .
OpenScienceSymposium    conf:takesPlaceAt    dbpedia:Chemnitz .
```

3. Publication under URL in Web, Intranet, Extranet

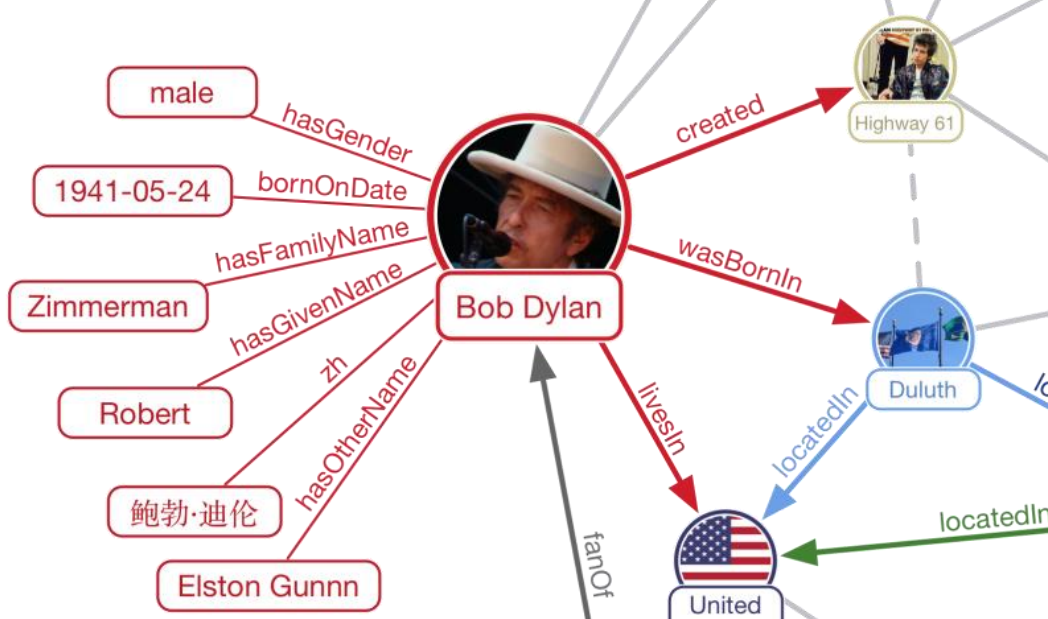
Linked Data

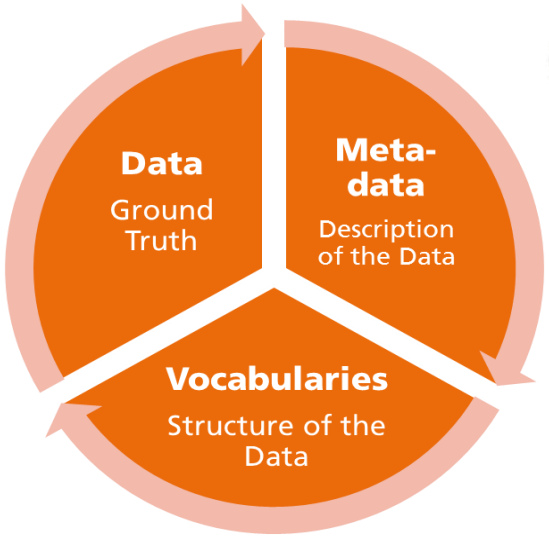
Creating Knowledge Graphs with RDF

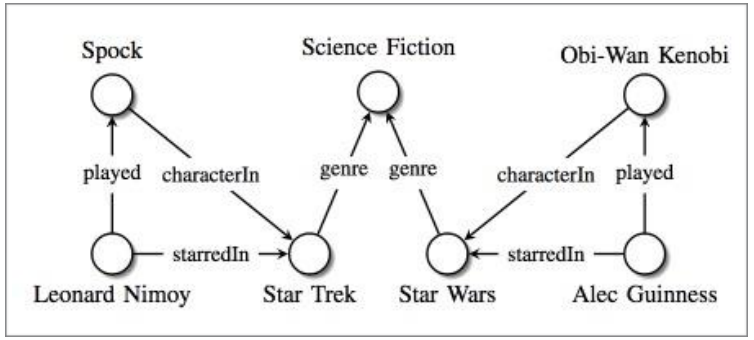


Knowledge Graphs – A definition

- Fabric of concept, class, property, relationships, entity desc.
- Uses a knowledge representation formalism (RDF, OWL)
- Holistic knowledge (multi-domain, source, granularity):
  - **instance data** (ground truth),
    - open (e.g. DBpedia, WikiData), private (e.g. supply chain data), closed data (product models),
  - derived, aggregated data,
  - **schema data** (vocabularies, ontologies)
  - **meta-data** (e.g. provenance, versioning, documentation licensing)
  - comprehensive **taxonomies** to categorize entities
  - **links** between internal and external data
  - **mappings** to data stored in other systems and databases





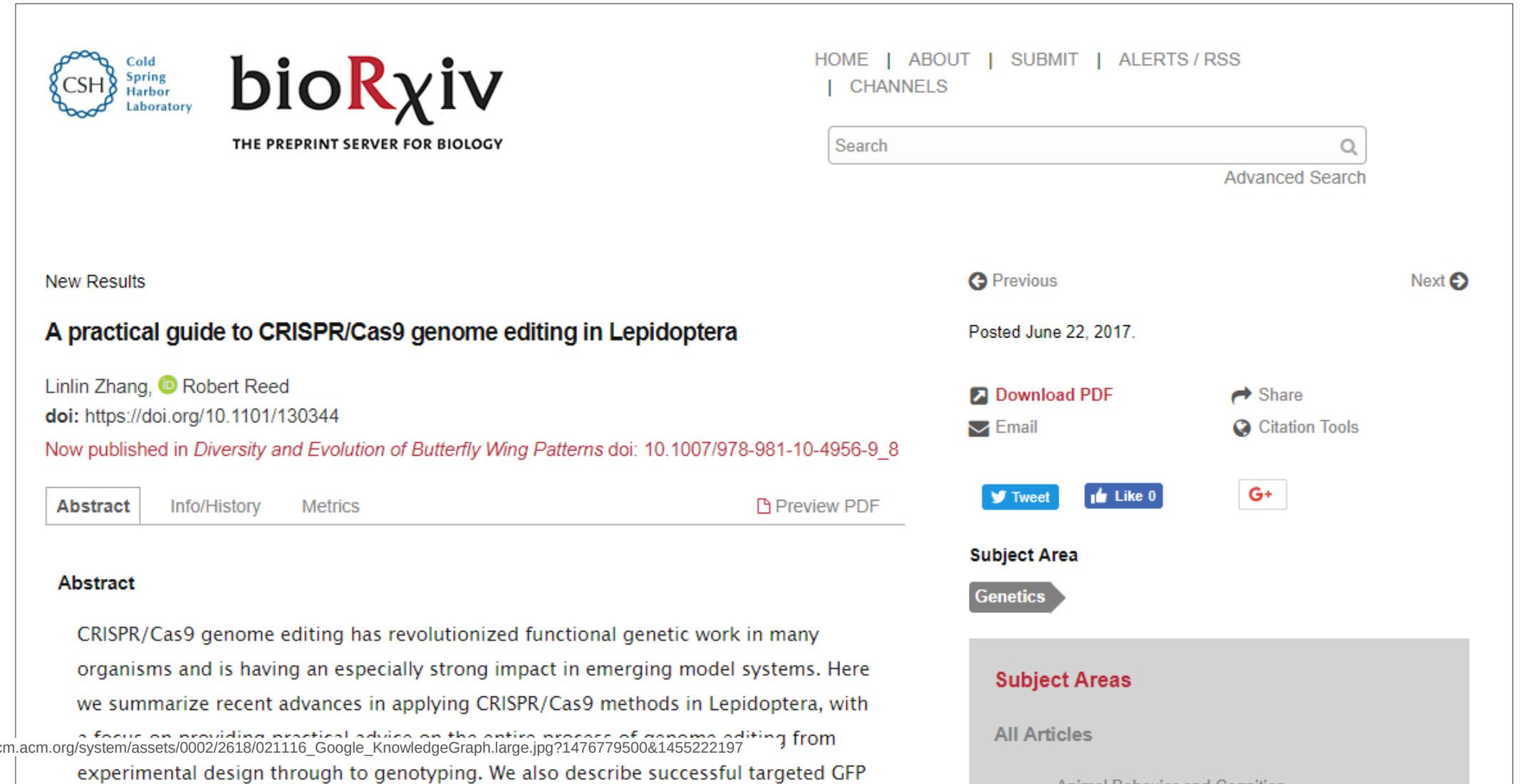


Source: https://pic2.zhimg.com/v2-878ad2a55c440b18c889394a7abaa5d3_1200x500.jpg

GND	
Link zu diesem Datensatz	http://d-nb.info/gnd/1021356255
Typ	Person (piz)
Person	Appelbaum, Anne
Geschlecht	weiblich
Zeit	Lebensdaten: 1908-1998
Land	Deutschland (XA-DE); USA (XD-US)
Geografischer Bezug	Wirkungsort: New York, NY
Beruf(e)	Psychologin
Beziehungen zu Personen	Cassirer, Ernst (Vater)
Beteiligt an	1 Publikation 1. *Nachgelassene Manuskripte und Texte / Bd. 1. Zur Metaphysik der symbolischen Formen* *1995*

Source: https://cacm.acm.org/system/assets/0002/2618/021116_Google_KnowledgeGraph.large.jpg?1476779500&1455222197

Chemistry Example: CRISPR Genome Editing



Cold Spring Harbor Laboratory

bioRxiv

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A practical guide to CRISPR/Cas9 genome editing in Lepidoptera

Posted June 22, 2017.

Linlin Zhang, Robert Reed

doi: https://doi.org/10.1101/130344

Now published in *Diversity and Evolution of Butterfly Wing Patterns* doi: 10.1007/978-981-10-4956-9_8

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Abstract

CRISPR/Cas9 genome editing has revolutionized functional genetic work in many organisms and is having an especially strong impact in emerging model systems. Here we summarize recent advances in applying CRISPR/Cas9 methods in Lepidoptera, with a focus on providing practical advice on the entire process of genome editing from experimental design through to genotyping. We also describe successful targeted GFP

Subject Area

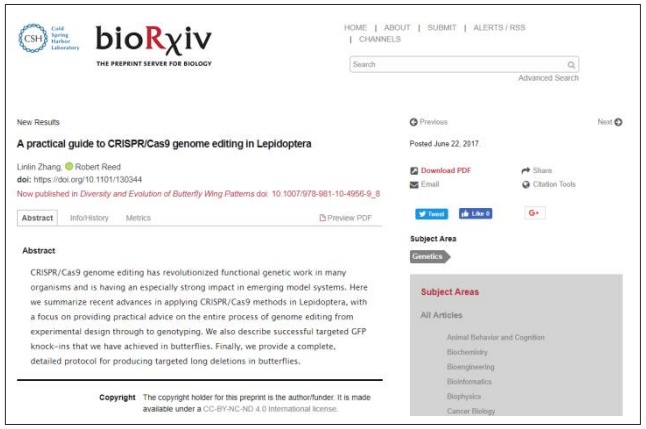
Genetics

Subject Areas

All Articles

Source: https://cacm.acm.org/system/assets/0002/2618/021116_Google_KnowledgeGraph.large.jpg?1476779500&1455222197

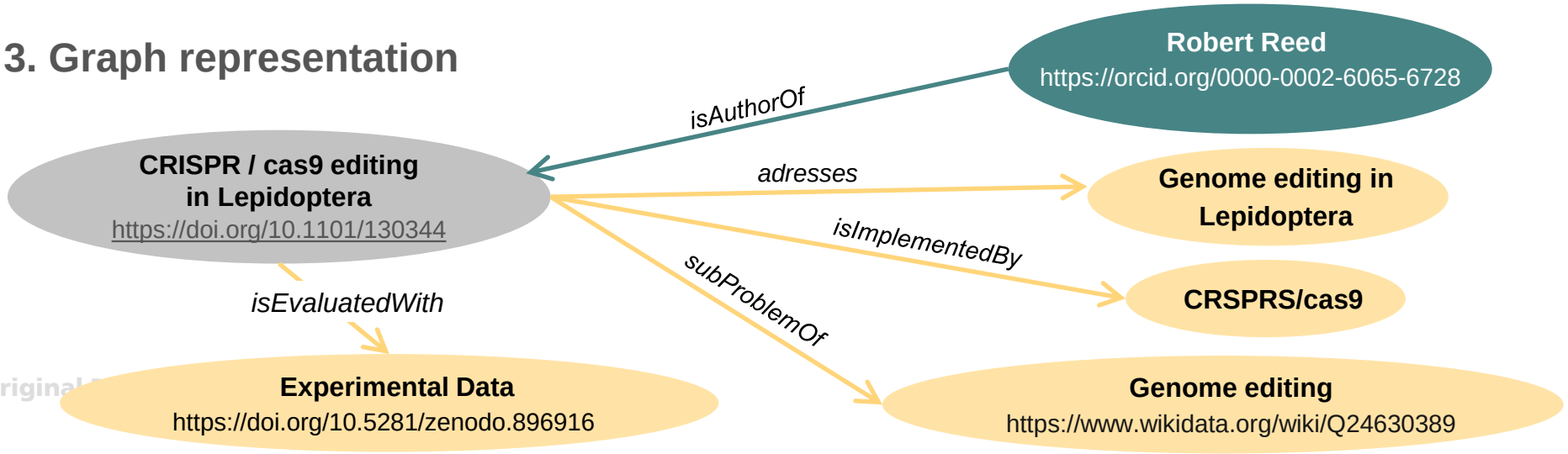
Chemistry Example: Populating the Graph



2. Adaptive Graph Curation & Completion

Author	Robert Reed
Research Problem	Genome editing in Lepidoptera
Methods	CRISPR / cas9
Applied on	Lepidoptera
Experimental Data	https://doi.org/10.5281/zenodo.896916

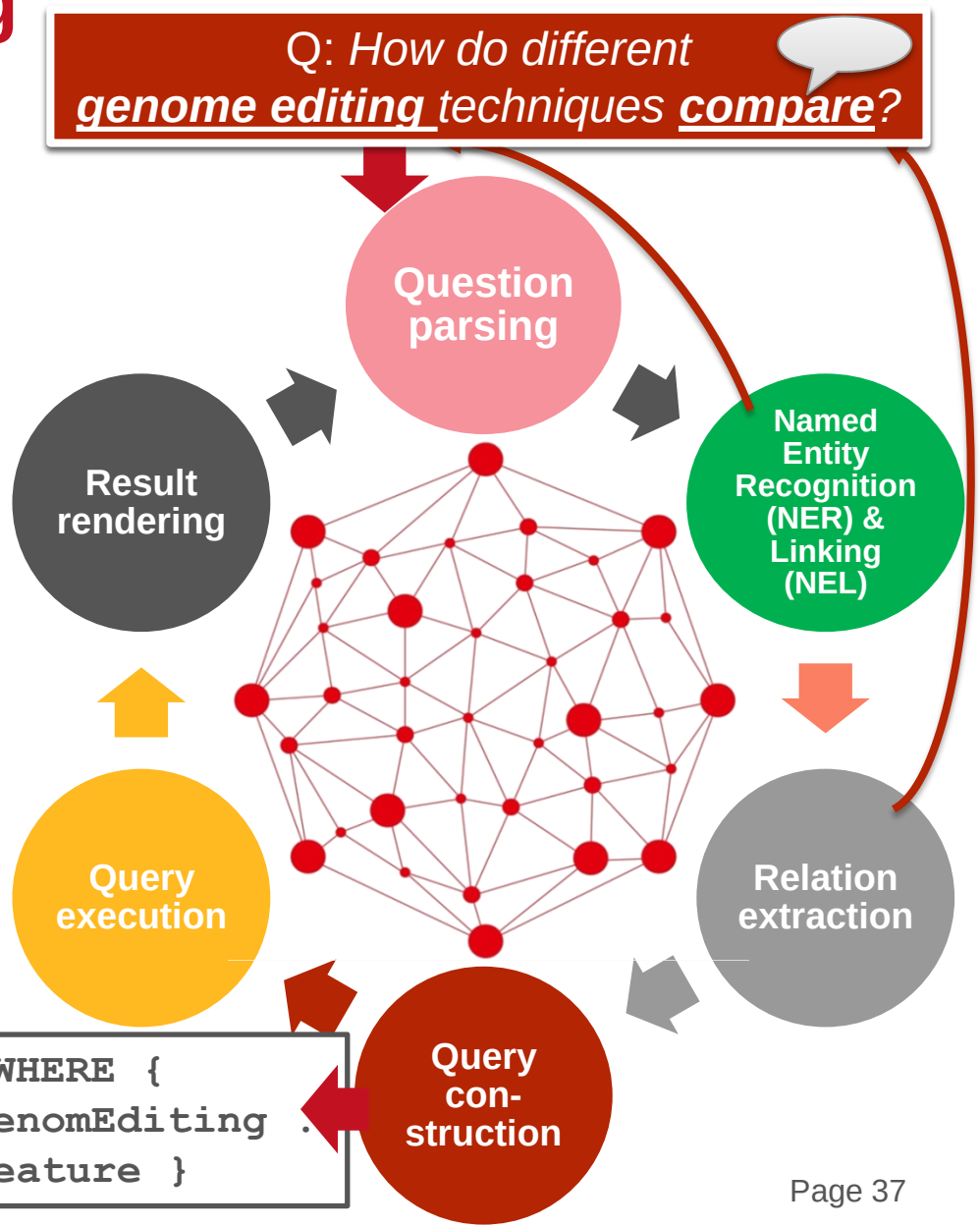
3. Graph representation



Exploration and Question Answering

Research Challenge:
- Intuitive exploration leveraging the rich semantic representations
- Answer natural language questions

ScienceGRAPH Approach:
- KG-based QA component integration for dynamic and automated composition of QA pipelines for cognitive knowledge graphs (e.g. following [1])
- Round-trip refinement and integration of search, faceted exploration, question answering and conversational interfaces




```
SELECT Approach, Feature WHERE {
  Approach  adresses     GenomEditing .
  Approach  hasFeature   Feature }
```


[1] K. Singh, S. Auer et al: *Why Reinvent the Wheel? Let's Build Question Answering Systems Together.* The Web Conference (WWW 2018).

Result:
Automatic Generation of Comparisons / Surveys

Q: How do different **genome editing** techniques **compare**?

Engineered Nucleases	Site-specificity	Safety	Ease-of-use / costs/ speed
zinc finger nucleases (ZFN)	++ 9-18nt	+	-- $$$: screening, testing to define efficiency
transcription activator-like effector nucleases (TALENs)	+++ 9-16nt	++	++ Easy to engineer 1 week / few hundred dollar
engineered meganucleases	+++ 12-40 nt	0	-- $$$ Protein engineering, high-throughput screening
CRISPR system/cas9	++ 5-12 nt	-	+++ Easy to engineer few days / less 200 dollar

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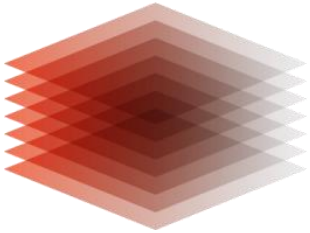
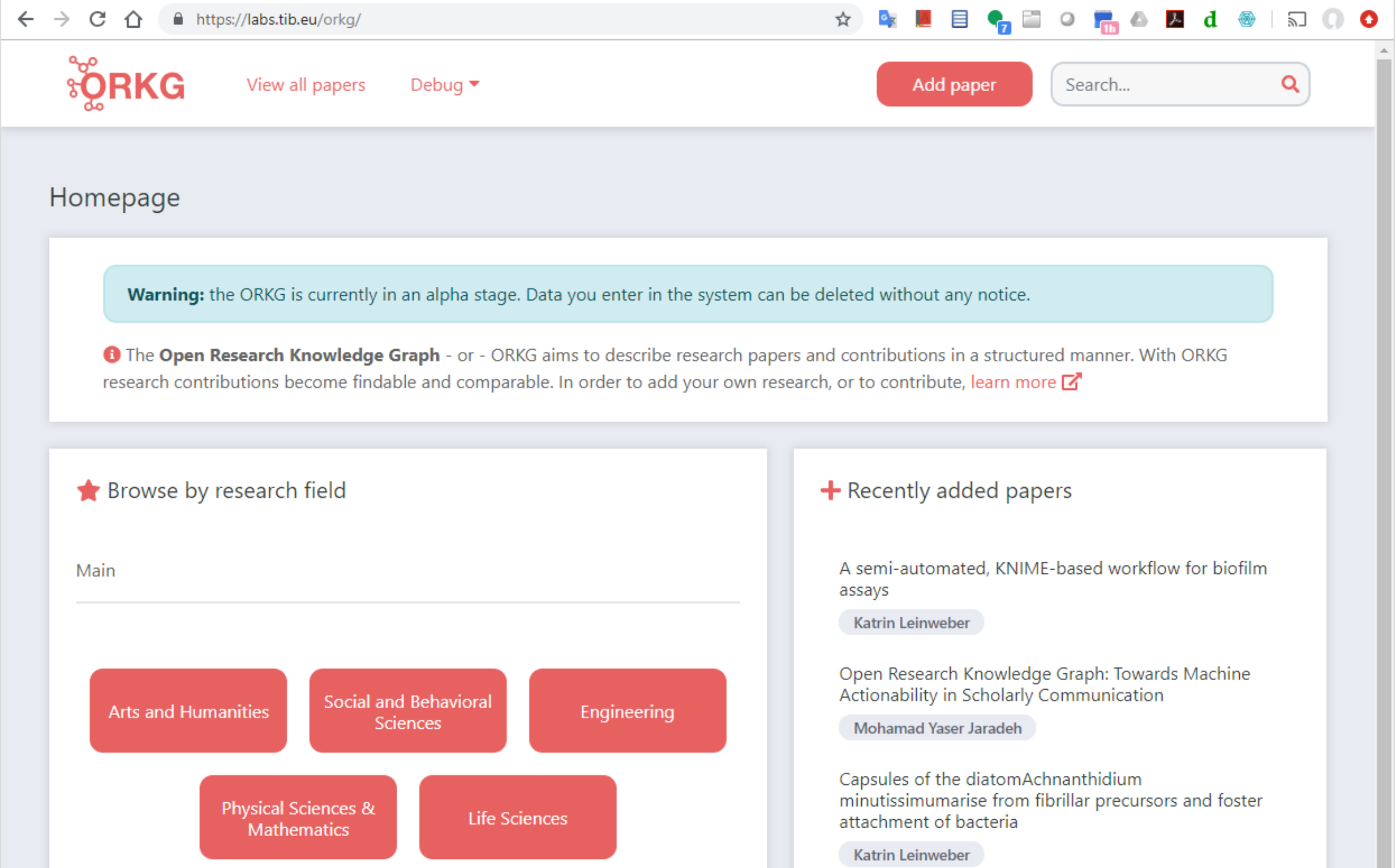


TIB

Demo: Open Research Knowledge Graph Prototype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ORKG
View all papers
Debug
Add paper
Search...
Homepage
Warning: the ORKG is currently in an alpha stage. Data you enter in the system can be deleted without any notice.
The Open Research Knowledge Graph - or - ORKG aims to describe research papers and contributions in a structured manner. With ORKG research contributions become findable and comparable. In order to add your own research, or to contribute, learn more
Browse by research field
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Social and Behavioral Sciences
Engineering
Physical Sciences & Mathematics
Life Sciences
Recently added papers
A semi-automated, KNIME-based workflow for biofilm assays
Katrin Leinweber
Open Research Knowledge Graph: Towards Machine Actionability in Scholarly Communication
Mohamad Yaser Jaradeh
Capsules of the diatomAchnanthidium minutissimumarise from fibrillar precursors and foster attachment of bacteria
Katrin Leinweber

Add paper

1 General — 2 Research field — 3 Contributions — 4 Finish

General paper data

By DOI | Manually

Paper DOI

10.1147/rd.225.0509 Lookup

Next step

Add paper

1 General — 2 Research field — 3 Contributions — 4 Finish

Select the research field

Arts and Humanities	Statistics and Probability	Theory/Algorithms
Social and Behavioral Sciences	Physics	Software Engineering
Engineering	Oceanography and Atmospheric Sciences and Meteorology	OS/Networks
Physical Sciences & Mathematics	Mathematics	Programming Languages/Compilers
Life Sciences	Earth Sciences	Numerical Analysis/Scientific Computing
	Computer Sciences	

Previous step | Next step

Add paper

1 General — 2 Research field — 3 Contributions — 4 Finish

General paper data

By DOI | Manually

Paper DOI

10.1147/rd.225.0509 Lookup

Lookup result

Paper title: Algorithm and Hardware for a Merge Sort Using Multiple Processors

Authors: S. Todd

Publication date: April 2010

Next step

Add paper

1 General — 2 Research field — 3 Contributions — 4 Finish

Specify research contributions

Contribution 1

+ Add another contribution

Research problems

Sorting algorithms ×

Contribution data

← Back | Main | Merge sort

- Programming language: *C++*
- Stable: *Yes*
- Best complexity: *n log n*
- Worst complexity: *n log n*

+ Add property

Previous step | Next step

View paper

Algorithm and Hardware for a Merge Sort Using Multiple Processors

April 2010 | Theory/Algorithms | S. Todd

Contribution 1

Research problems

Sorting algorithms

Contribution data

← Back | Main | Merge sort

- Worst complexity: *n log n*
- Best complexity: *n log n*
- Programming language: *C++*
- Stable: *Yes*

Similar contributions

Show full comparison

80 %	A variant of heapsort with almost optimal number of comparisons
54 %	Bubble sort: an archaeologic alalgorithmic analysis

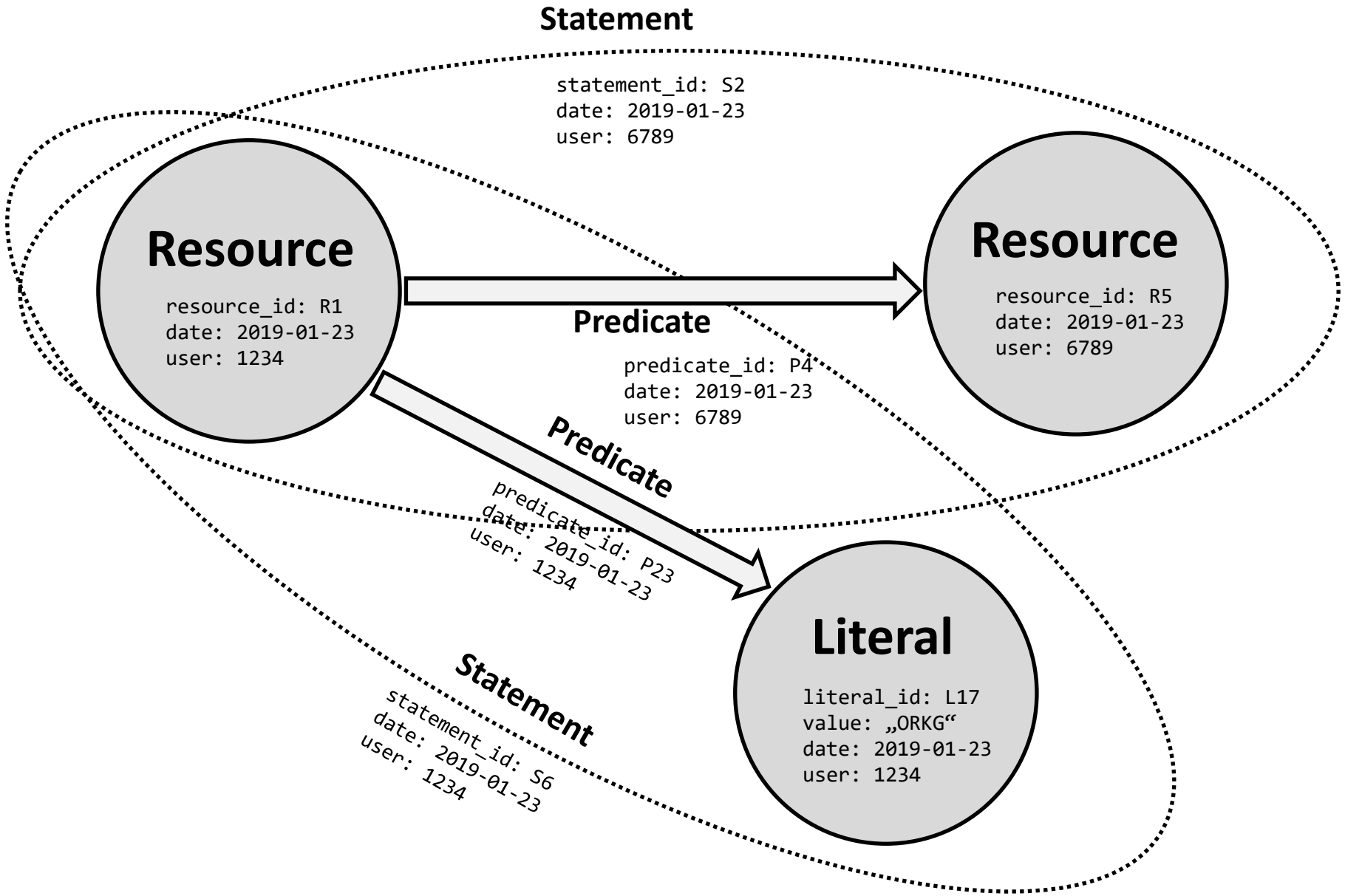
Contribution comparison

Compare

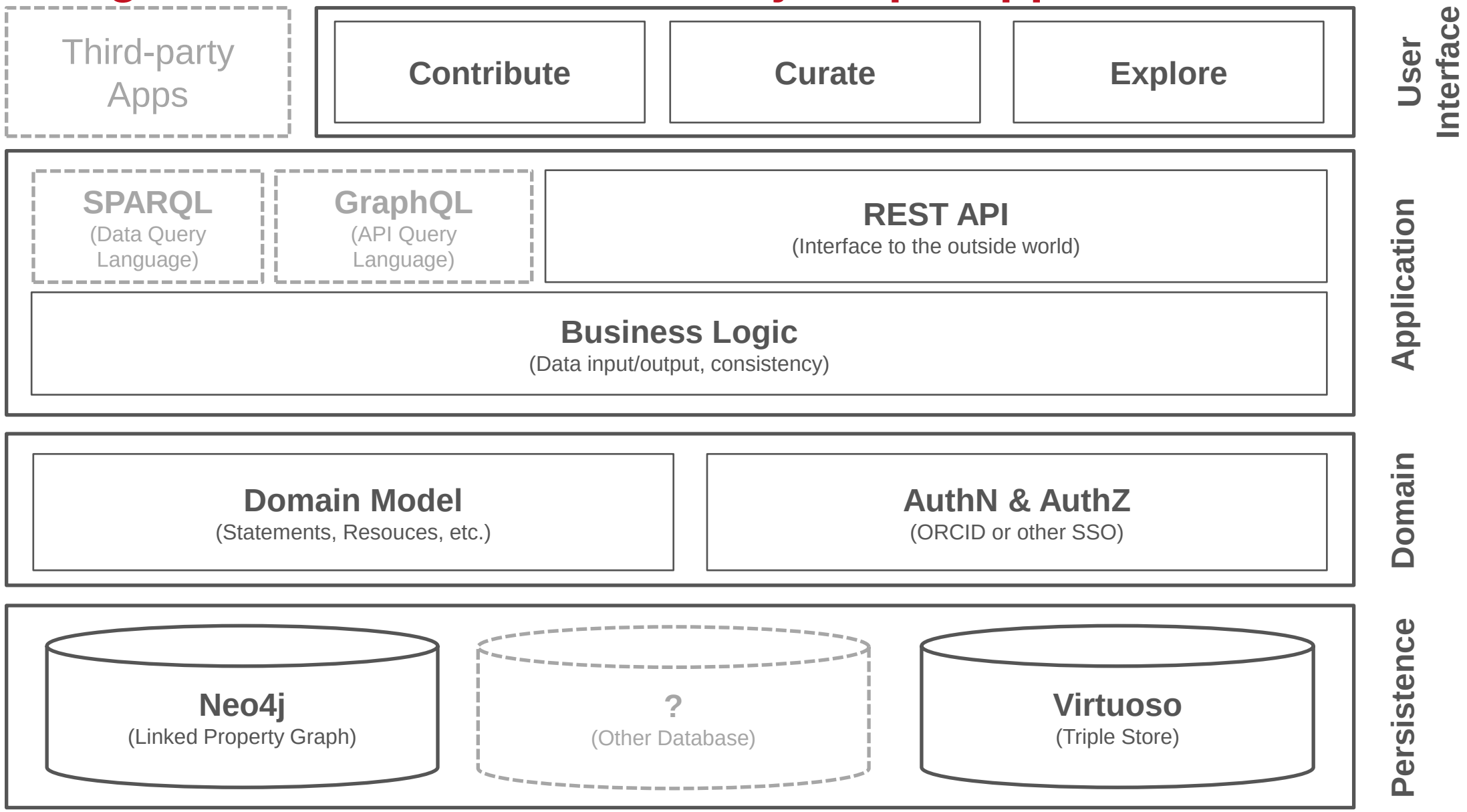
Add to comparison

Properties	Algorithm and hardware for a merge sort using multiple processors Contribution #2	A variant of heapsort with almost optimal number of comparisons Contribution #1	Bubble sort: an archaeologic alalgorithmic analysis Contribution #1
Algorithm	Merge sort	Heap sort	Bubble sort
Problem	Efficient sorting	Efficient sorting	Sorting
Programming language	C++	*Empty*	Python
Stable	Y	N	N
Best complexity	n log n	n	n
Worst complexity	n log n	n log n	n log n

High-level Data Model: RDF + Metadata



High-Level Architecture: Neo4j Graph Application



European Heart Journal (2017) **38**, 362–372
doi:10.1093/eurheartj/ehw333

BASIC SCIENCE

Iron-regulatory proteins secure iron availability in cardiomyocytes to prevent heart failure

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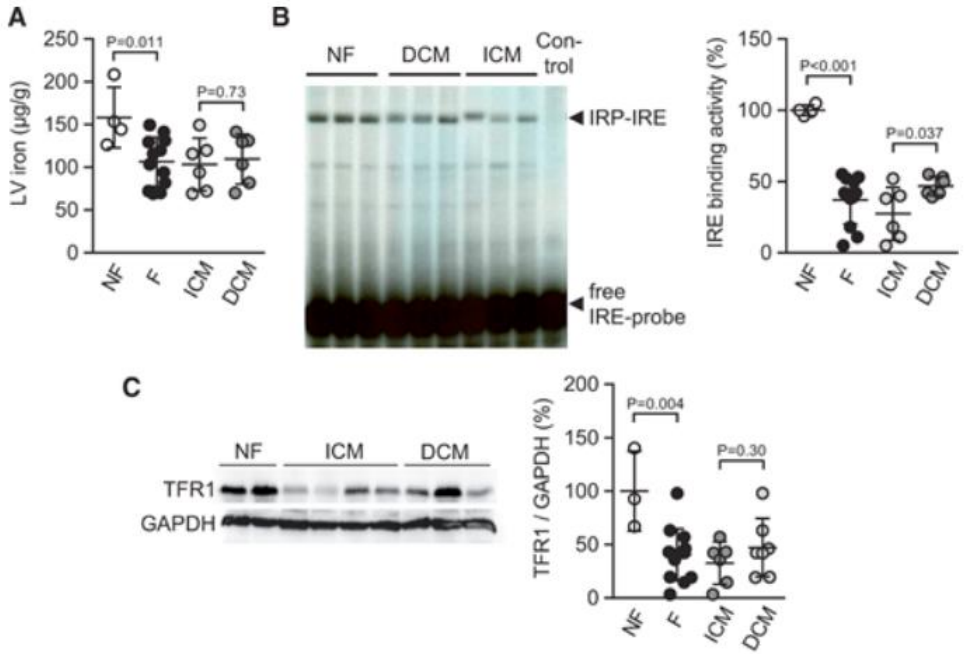
See page 373 for the editorial comment on this article (doi: 10.1093/eurheartj/ehw386)

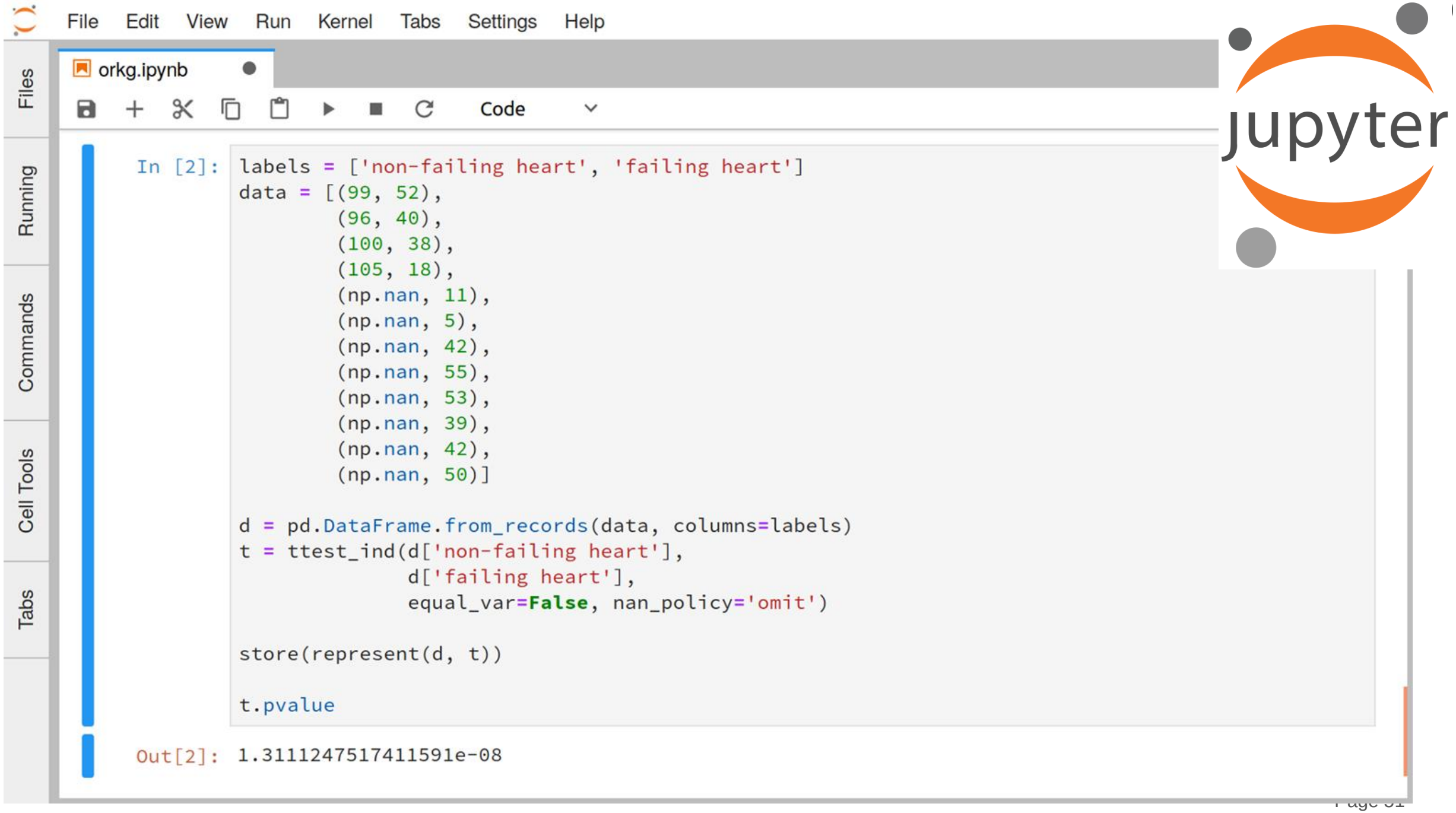
Results

Reduced iron content, IRE binding activity, and transferrin receptor expression in the failing human heart

Consistent with previous reports,[5,6] iron concentration was significantly lower in LV tissue samples from patients with advanced heart failure than in LV tissue samples from unused donor hearts (*Figure1A*). As shown by electrophoretic mobility shift assays, IRE binding activity was significantly reduced in failing hearts (most pronounced in patients with ischemic cardiomyopathy) (*Figure1B*). Protein expression levels of the transferrin receptor were significantly lower in failing hearts than in the controls (*Figure1C*).

Figure 1

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Code
In [2]:
labels = ['non-failing heart', 'failing heart']
data = [(99, 52),
(96, 40),
(100, 38),
(105, 18),
(np.nan, 11),
(np.nan, 5),
(np.nan, 42),
(np.nan, 55),
(np.nan, 53),
(np.nan, 39),
(np.nan, 42),
(np.nan, 50)]
d = pd.DataFrame.from_records(data, columns=labels)
t = ttest_ind(d['non-failing heart'],
d['failing heart'],
equal_var=False, nan_policy='omit')
store(represent(d, t))
t.pvalue
Out[2]:
1.3111247517411591e-08
jupyter

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Add paper

1 General — 2 Research field — 3 Contributions — 4 Finish

General paper data

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10.1093/eurheartj/ehw333 Lookup

Next step

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General paper data

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Authors: Saba Haddad, Yong Wang, Bruno Galy, Mortimer Korf-Klingebiel, Valentin Hirsch, Abdul M. Baru, Fatemeh Rostami, Marc R. Reboll, Jörg Heineke, Ulrich Flögel, Stephanie Groos, André Renner, Karl Toischer, Fabian Zimmermann, Stefan Engeli, Jens Jordan, Johann Bauersachs, Matthias W. Hentze, Kai C. Wollert, Tibor Kempf

Publication date: August 2016

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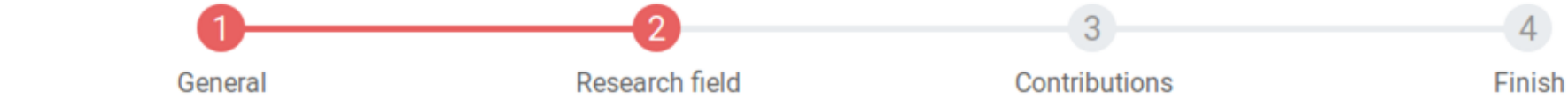

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Contribution 1

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Contribution data

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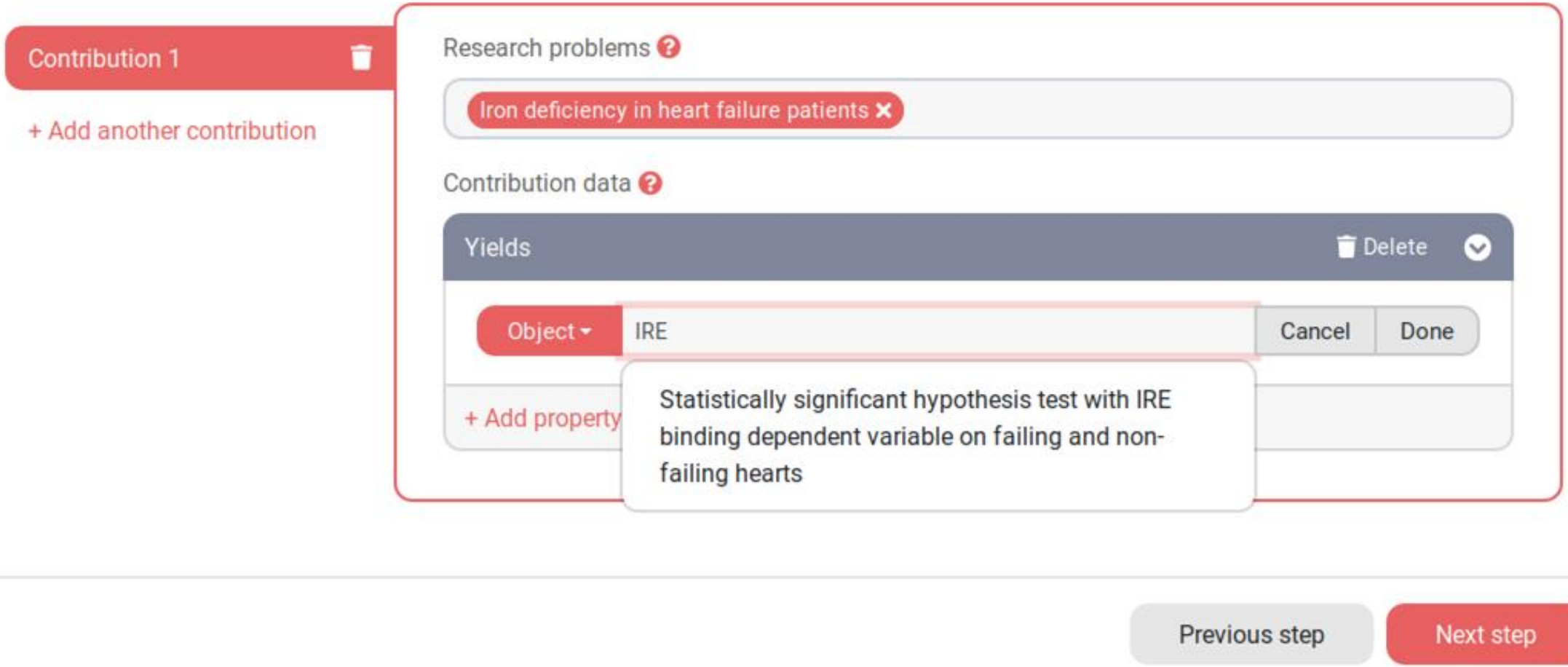
Contribution 1
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+ Add property
Statistically significant hypothesis test with IRE binding dependent variable on failing and non-failing hearts
Previous step
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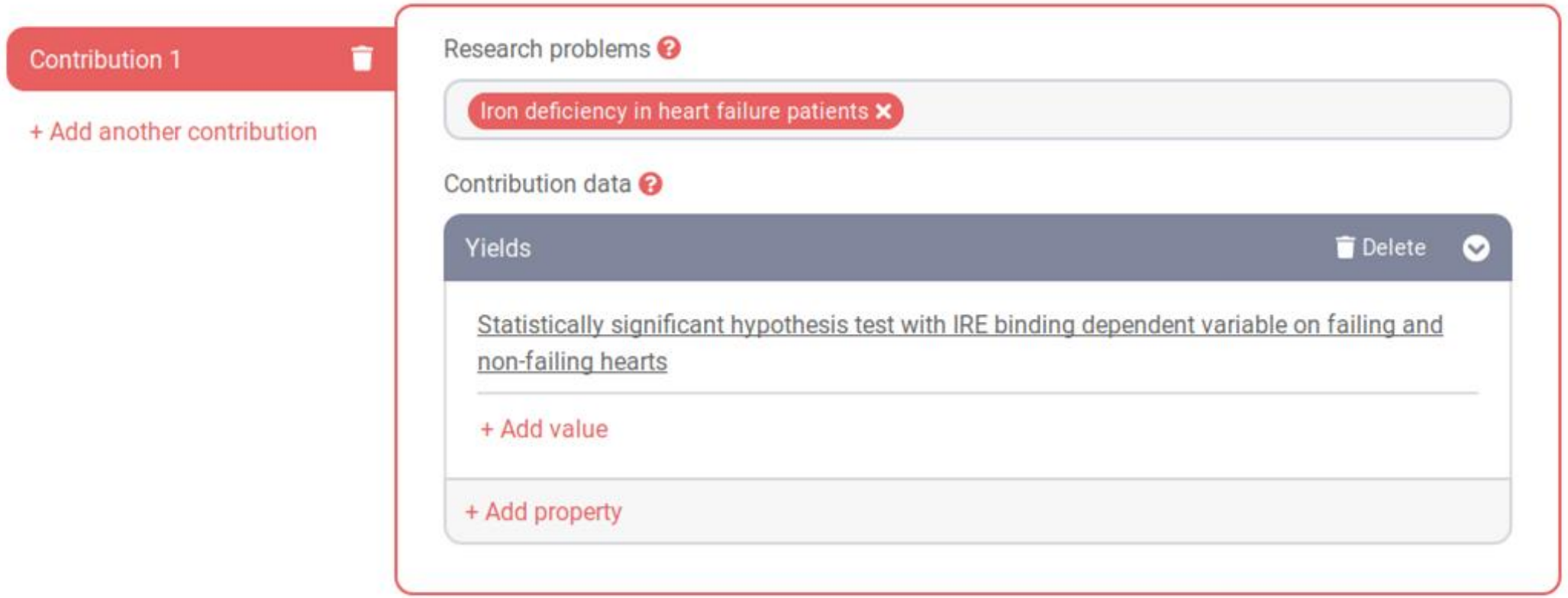
Contribution 1
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Iron deficiency in heart failure patients
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Statistically significant hypothesis test with IRE binding dependent variable on failing and non-failing hearts
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Research problems

Iron deficiency in heart failure patients

Contribution data

← Back | Ma | Statistically significant hypothesis test with IRE binding dependent variable on failin

- Has specified output: *the p-value of the statistical hypothesis test*
- Type: *two sample t-test with unequal variance*
- Has specified input: *3 values*
- Label: *Statistically significant hypothesis test with IRE binding dependent variable on failing and non-failing hearts*

Research problems

Iron deficiency in heart failure patients

Contribution data

← Back

Main Stat the p-value of the statistical hypothesis test

Has value specification: *the value specification of the p-value*

Type: *p-value*

Label: *the p-value of the statistical hypothesis test*

Research problems

Iron deficiency in heart failure patients

Contribution data

← Back | Mair | Stati | the p | the value specification of the p-value

Type: *scalar value specification*

Has specified numeric value: *1.3111247517411591e-08*

Label: *the value specification of the p-value*

Research problems

Iron deficiency in heart failure patients

Contribution data

← Back Ma Statistically significant hypothesis test with IRE binding dependent variable on failin

Has specified output: *the p-value of the statistical hypothesis test*

Type: *two sample t-test with unequal variance*

Has specified input

- failing heart
- the study design dependent variable
- non-failing heart

Label: *Statistically significant hypothesis test with IRE binding dependent variable on failing and non-failing hearts*

Research problems

Iron deficiency in heart failure patients

Contribution data

← Back | Main | Stati | the study design dependent variable

Type

study design dependent variable

iron-responsive element binding

Label: *the study design dependent variable*

Term of the Gene Ontology, namely GO:0030350

Research problems

Iron deficiency in heart failure patients

Contribution data

← Back | Main | Stati | non-failing heart

Has part

- the scalar measurement datum #3
- the scalar measurement datum #1
- the scalar measurement datum #4
- the scalar measurement datum #2

Type: *continuous variable*

Label: *non-failing heart*

Research problems

Iron deficiency in heart failure patients

Contribution data

← Back

Mair | Stati | non- | the s | the value specification #4

Type: *scalar value specification*

Has specified numeric value: *105.0*

Label: *the value specification #4*

Research problems

Iron deficiency in heart failure patients

Contribution data

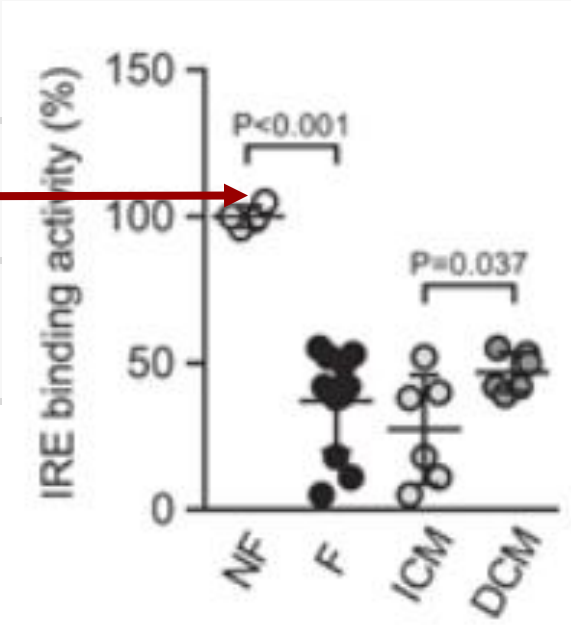
← Back

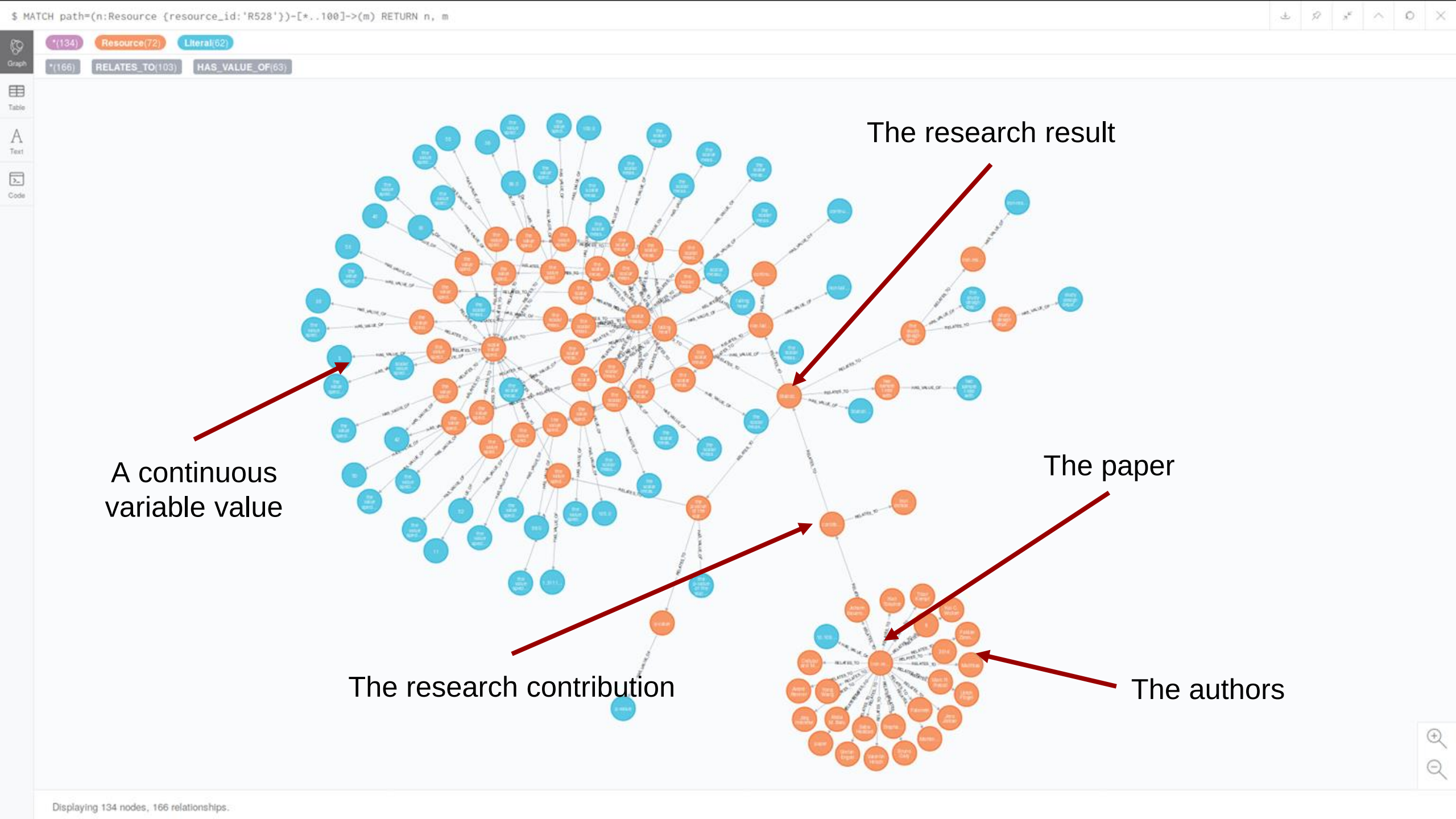
Main | Stati | non- | the s | the value specification #4

Type: *scalar value specification*

Has specified numeric value: *105.0*

Label: *the value specification #4*




$ MATCH path=(n:Resource {resource_id:'R528'})-[*..100]->(m) RETURN n, m
*(134)
Resource(72)
Literal(62)
*(166)
RELATES_TO(103)
HAS_VALUE_OF(63)
Graph
Table
Text
Code
The research result
A continuous variable value
The paper
The research contribution
The authors
Displaying 134 nodes, 166 relationships.

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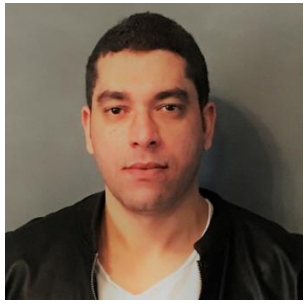
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Project Management


Alex Garatzogianni


Laura Granzow

Conclusions

- We need to **reinvent scholarly communication**
- **Knowledge Graphs are perfectly suited to capture research contributions in a structured and semantic way making them human and machine interpretable**
- With our **Open Research Knowledge Graph initiative we aim to establish a registry for research contributions** (maybe similar to some extend as Crossref for DOIs/bibliographic metadata)

Stay tuned

- https://tib.eu
- Mailinglist/group: https://groups.google.com/forum/#!forum/orkg
- Open Research Knowledge Graph: https://orkg.org
- ERC Consolidator Grant ScienceGRAPH started in May

European Research Council

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